CHAPTER IX

Creating a Munitions Industry

Perhaps the most vital part of the vast national defense effort in which the United States is engaged is the supplying of weapons and ammunitions to its armed forces. This is so because these items, not being among the commercial products of industry, require a relatively long time to produce in the quantities essential to a major defense effort. At present men can be trained more rapidly than munitions can be provided.

Thus William H. Harrison reminded the National Defense Advisory Commission of the disparity between manpower and munitions in November 1940.[1] As shelter became available and the strength of the Army increased, the disparity grew. Men inadequately armed were a weak defense. Not until new government-owned munitions plants were in production could mobilization be effective. Anxiety over camps and cantonments for a time pushed munitions projects from the forefront of attention, but this seeming indifference to industrial preparedness did not long continue. As American involvement in global war became an unmistakable probability, arsenals, plants, and depots became objects of deep concern.

Before the first "goldfish bowl" drawing for the draft on 16 October 1940, Congress had voted nearly $750 million for "expediting production." Not all of this money was for plants to manufacture explosives, ammunition, tanks, and guns. Indeed, well over a third was for aircraft factories. Because the sums for expediting production of critical items of equipment for the ground forces appeared inadequate, the War Department drew on moneys appropriated for other purposes. The largest supplement came from Ordnance procurement funds. By late October, the Army had allotted roughly $700 million for constructing and equipping new facilities to make and store munitions.[2]

Although broad aims had been agreed upon in June 1940, defining the munitions program in terms of plants, their number, type, and size, consumed many months. Resolving military plans into "specific items of munitions," hard enough at any time, was particularly so in 1940. The fact that the 30 June munitions program was based on a figure of two million men, instead of four million as in the Protective Mobilization Plan, forced major readjustments in plans of the using services.[3] Frequent changes in the Army's organization, mobilization rate, and operational plans made necessary further adjustments. Job directives appeared intermittently during the latter half of 1940,

[1] Rpt, Constr Sec NDAC, 1 Nov 40, sub: Mun Plant Constr—U.S. Army. Madigan Files, 101.7 Mun Plant Constr.

[2] (1) *Ibid.* (2) Rpt, OUSW, 24 Jan 41, sub: Summary of Constr Program for Manufacturing Facils. USW Plng Div, 600.1—134 Constr (1 Jun 40–25 Mar 41).

[3] Memo, OCofOrd for OUSW, 26 May 41. USW Files, Legis—H and S Investigating Comm 1.

but not until February 1941 did the first munitions plant program take final form. By that time the Army had under way 34 manufacturing facilities, 29 for the Ordnance Department and the remainder for the Chemical Warfare Service. Included were 5 shell loading plants, 3 small arms ammunition plants, 3 explosives plants, and 2 anhydrous ammonia plants, as well as facilities for turning out tanks, shells, armor plate, toluol, charcoal-whetlerite, and M1 rifles and factories for making and bagging smokeless powder. Generally known as the "first wave plants," these facilities were to have stand-by status after the emergency. Together with proving grounds and depots to test and store end-products, they constituted a minimum requirement for defense.[4]

Status of the Program—December 1940

When Somervell succeeded Hartman on 11 December 1940, one munitions project, a bomb loading plant at the Savanna Ordnance Depot, was complete and construction was under way at 16 others—new manufacturing facilities and expansions of old-line arsenals. Detailed surveys were going forward at sites for 3 ammunition storage depots. Contracts had recently been let for 2 more plants and a proving ground and contractors nominated for 4 additional plants. Despite its somewhat mixed record in other areas, the division's conduct of industrial work was generally rated good. Hartman had taken an average of twenty-three days to translate directives into contracts and an average of eighteen days to get construction started after contracts were signed. Considering all he had to contend with—the frequent changes in capacity, design, and location of plants, the complexity of negotiations, and the magnitude of the jobs—this was a creditable achievement. Projects, once begun, made fairly steady progress. Most were due for completion in the summer or fall of 1941, which left a reasonably comfortable margin of time.[5] On 29 November Harrison reported to Knudsen: "The longer term projects (munitions, Quartermaster depots, etc.) generally are in good shape."[6]

Although munitions projects did not present him with a crisis in the sense that camps and cantonments did, the status of the industrial program caused the new Chief of Construction some misgivings. To be sure, going projects appeared to be more or less on schedule and several jobs were well ahead. Nevertheless, there were signs of trouble. Contracts were pending for 13 directed projects: 4 ammunition storage depots, 3 Chemical Warfare plants, 2 shell loading plants, 2 bag loading plants, 1 small arms ammunition factory, and 1 explosives works. Orders for 9 of these jobs dated from November, two from October, and two from September. Seven more directives were in the offing, but no one could tell how soon they would appear. At plant as well as at camp projects, overruns were becoming common. Moreover, two important questions remained unanswered: precisely how much production capacity would be needed, and when. While directing most of his ef-

[4] (1) Harry C. Thomson and Lida Mayo, *The Ordnance Department: Procurement and Supply*, UNITED STATES ARMY IN WORLD WAR II (Washington, 1960), pp. 45–59. (2) Ltr, OCofOrd to USW, 9 Jun 41. Ord 675/9233–Misc.

[5] (1) Constr Div Progress Charts and Rpts. EHD Files. (2) Rpt, Activities of Constr Div, Jul 40–Jul 41, pp. 196–238.

[6] Memo, Harrison for Knudsen, 29 Nov 40. WPB–PD File, 411.33 Constr Projs—Mil, Jun 40–41.

forts to more immediate problems, Somervell gave the munitions program considerable thought and study.

He quickly identified the source of some of the trouble. In his initial report to General Gregory on 9 December, he noted that "the number of agencies involved" in the munitions program had "introduced complications." Too many discordant voices were calling the tune. As a result, confusion attended site selection, planning, design, and supervision. While agreeing that the using services "must, of course, be consulted," Somervell wished to streamline procedures and expedite decisions; and he felt the Construction Division ought to have a larger role.[7] As he probed more deeply into the workings of the program, he found little reason for altering these views.

Disputes over plant locations were delaying the start of several Ordnance projects. One such dispute involved the second anhydrous ammonia plant. In October Ordnance and its operator, the Allied Chemical and Dye Corporation, had proposed a site near South Point, Ohio. But Commissioners Davis and Hillman of NDAC held out for another location, near the depressed community of Carbondale, Illinois. When Somervell joined Gregory in December, the issue was deadlocked. Similar disagreements were blocking construction of the New River and Hoosier bag loading plants and the Plum Brook explosives works.[8] The delays seemed likely to continue. At a meeting of the Advisory Commission early in December, Davis said, "It was possible undue emphasis was given in making these recommendations to the wishes of industrial management compared with other factors which appear important to the Commission."[9] Ordnance took a different view. "The Country was faced with war," General Campbell afterward explained. "Ordnance was responsible for getting munitions in the hands of troops in sufficient quantity and *on time*. No one else was."[10] Not a party to decisions affecting plant locations, the Construction Division could only wait until Ordnance and NDAC composed their differences.

Further examples of snags which delayed commencement of construction were offered by the small arms ammunition plants—the most notable laggards among Ordnance projects. The decision to build three such plants came early in October 1940. Hartman succeeded in awarding the construction contract for one of them, the Lake City Ordnance Plant at Kansas City, Missouri, late in November; construction began two days after Somervell took over. Earlier, though, the directive for this contract had waited for more than five weeks, while Ordnance reviewed planned capacity and site boundaries.[11] The division was involved to a degree in delays at the second project, the St. Louis Ordnance Plant. Negotiations with the two firms selected to act as joint venturers, the Fruin-Colnon Contracting Company and the Massman

[7] Memo, Somervell for Gregory, 9 Dec 40. EHD Files.

[8] (1) Memo, OCofOrd Industrial Svc Facil for Rutherford, 22 Oct 40. Ord 675/1202 (Ohio River OW—Misc). (2) Memo, OCofOrd Industrial Svc Facil for Rutherford, 22 Nov 40. Ord 675/1636 (Misc). (3) *Minutes of the NDAC*, pp. 120–30.

[9] *Minutes of the NDAC*, p. 120.

[10] Comments of Gen Campbell on Constr MS, VIII, 52.

[11] (1) Memo, Reybold for Patterson, 3 Oct 40. G–4/38773. (2) Memo, OCofOrd Industrial Svc Facil for Rutherford, 20 Sep 40. (3) Memo, OASW, Plng Br for CofOrd, 26 Oct 40. Both in Ord 675/643 (Misc). (4) Memo, OCofOrd Industrial Svc Facil for Hartman, 19 Oct 40. 635 (Lake City OP) I.

Construction Company, were complete by 11 December. Somervell started to submit the contract to NDAC the next day but ran into a storm of political protest. He stuck to his guns and finally, on 30 December, secured Knudsen's permission to put through the deal with Fruin-Colnon and Massman.[12] A site for the third small arms ammunition plant was not finally chosen until mid-December. Ordnance had originally considered building this plant near Atlanta or in the Tennessee Valley, but by late November had decided in favor of Denver. The President approved the Denver site on 18 December and Ordnance promptly issued the directive. But even then, uncertainty as to the scope of the project threatened to hold up negotiations for some time.[13]

Visiting the plant sites, Somervell noted a source of potential, if not actual, delay—blurred lines of authority. Early in the program Hartman had had to yield in matters concerning supervision of construction. Short of experienced Quartermaster officers, he had let Ordnance take charge of building operations at a number of key jobs. At four of the first major projects, Indiana, Radford, Elwood, and Baytown, the commanding officer, a representative of the Ordnance Department, also served as Constructing Quartermaster. At Kankakee, the first TNT plant, and at Ravenna, one of the early shell loaders, the Constructing Quartermasters were Ordnance officers junior to the commanding officers. At eleven other projects, the CQM's were Hartman's men—long-time Regulars like Colonel McFadden at Springfield Armory; West Point careerists like Capt. Joseph E. Gill at the Savanna Ordnance Depot; and outstanding Reservists like Maj. Harry R. Kadlec at the Detroit Tank Arsenal. These men were capable administrators, but competence was not always the deciding factor in determining who would boss construction. At most projects Ordnance representatives outranked Hartman's officers.[14]

Neither practice nor results were uniform. In October the Hercules Powder Company had complained that the Ordnance officer at Radford "did not have sufficient authority or experience to make decisions on minor matters without referring to Washington or Wilmington."[15] After touring the projects, Somervell reported that the officer at Elwood "has apparently attempted to 'command' the Architects and Engineers who know more about construction than he will ever know." By contrast, he found the Indiana job "operating in a highly satisfactory way." But even where work was proceeding smoothly, the situation was far from ideal. The Reserve major sent by Hartman to Picatinny Arsenal could hardly be expected to question the wisdom of the commanding officer, a brigadier general whose service in the

[12] (1) Memo, Loving for Hartman, 11 Dec 40. EHD Files. (2) Memo, Gregory for Somervell, 13 Dec 40. 635 (St. Louis OP) I. (3) Memo, Constr Adv Comm for Somervell, 19 Dec 40. (4) Memo, Somervell for Knudsen, 28 Dec 40, and approval thereon. Last three in 635 (St. Louis OP) I.

[13] (1) Memo, OCofOrd Industrial Svc Facil for Hartman, 19 Oct 40. QM 095 (Remington Arms Co.). (2) Memo, OCofOrd Industrial Svc Facil for Rutherford, 25 Nov 40. Ord 675/1647 (Denver OP—Misc). (3) Memo, OCofOrd Industrial Svc Facil for Somervell, 18 Dec 40. 635 (Denver OP) I. (4) Memo, OCofOrd Industrial Svc Facil for Somervell, 21 Jan 41. Ord 675/2911 (Misc).

[14] Data compiled from EHD Files, Industrial-Projs.

[15] Memo, OASW, E. B. Isaak, for Madigan, 22 Oct 40. Madigan Files, Radford, Va., Smokeless Powder Plant.

Regular Army dated back to 1901. Ordnance officers on duty as Constructing Quartermasters, however well-intentioned, found it difficult to serve two masters. When these men had to choose between enforcing Construction Division policy and preserving what the Ordnance Department regarded as its prerogatives, their older loyalty often proved the stronger.[16]

Costs presented another dreary picture. At project after project, original estimates were turning out to be low. When Hercules signed the prime contract on 16 August 1940, the estimated cost of building the Radford plant and of operating it for one year was $25 million. Less than three months later the figure had risen to $40 million. A partial explanation lay in an additional line. Similarly, at the Indiana plant the number of lines doubled within three and tripled within five months of the signing of the contract.[17] By December General Campbell saw that many of the original estimates, made when "limited information was available," would "prove to have been greatly below" actual costs.[18]

Despite their various ailments, munitions projects received only incidental therapy in the weeks following Somervell's appointment. Reorganization of the division wrought but one significant change in the groups concerned with industrial construction—the placing of all field operations under

FRANK R. CREEDON

Frank R. Creedon and his principal assistants, William E. O'Brien, William K. Maher, Otto F. Sieder, and George F. Widmyer. Minutes of Somervell's staff conferences made but passing mention of the Ordnance and Chemical Warfare programs. Relations with Ordnance took on an easy-going air, which seemed to belie the differences between the two services, but which really proceeded from the fact that Somervell was preoccupied with other issues. But problems overshadowed were not solved any more than decisions deferred were permanently avoided.

Dollars Versus Days

While the spotlight focused on camps and cantonments, Campbell and Groves were uneasy about the progress of industrial preparedness. As the heads of the Ordnance Department's Industrial Service, Facilities, and the Construction

[16] Memo, Somervell for Gregory, 9 Dec 40.

[17] (1) Memo, OCofOrd Industrial Svc Facil for Knudsen, 1 Aug 40. Ord 675/119 (Radford—Misc). (2) Compl Rpt, Radford OW, 1940–43, Introd. (3) Memo, OCofOrd for ASW, 2 Nov 40. Ord 675/1335 (Radford—Misc). (4) Compl Rpt, Indiana OW, 6 Nov 42, pp. 2–3.

[18] Memo, Campbell for Groves, 13 Dec 40. QM 635 (Shops, Ord Repairs) 1940.

Division's Operations Branch, they bore a heavy responsibility for the munitions plant program, a responsibility they keenly felt. Telephoning Groves on 10 December 1940, General Campbell said: "Two guys are going to hold the bag, Campbell and Groves. You won't have the plants ready. I can't make TNT until the Quartermaster gives me the plant." Groves mentioned one solution, to put the projects on a three-shift basis. "It is going to cost money," he told Campbell, "and if anybody doesn't like it after we have started, we say, 'What are you going to do about it?' "[19] The problem, both men recognized, was not that simple. Funds were short and goals uncertain. Unless money was available and its spending could be justified, wholesale use of crash methods was out of the question.

On 13 December Campbell asked Groves to find out how much the munitions projects were actually going to cost. By making financial arrangements "without delay to take care of any shortages," Ordnance hoped to avoid "showing large deficits upon completion of plants." Complying with Campbell's request, Groves directed Constructing Quartermasters at all Ordnance projects to submit revised estimates of cost. The results were soon apparent. Ordnance projects would show deficits totaling about $100 million.[20]

Meanwhile, Groves and Somervell had appealed to Ordnance for firm completion dates. The deadlines originally announced were seldom final or exact. Some were set forth in general terms. The expectation was that the Iowa and Kingsbury shell loading plants would take about ten months to build; the Lake City small arms ammunition plant, about one year. Other completion dates, giving month and day, changed again and again, sometimes drastically.[21] Not knowing how fast to proceed or how heavily to spend, Somervell in mid-December appealed to the Chief of Ordnance for "honest-to-God" completion dates. General Wesson turned the request over to Col. Francis H. Miles, Jr., of the Ammunition Division, giving him ten days to prepare an answer. Miles' was no easy assignment, since completion hinged on deliveries of processing machinery. As Campbell put it, "No use having the buildings when we have no equipment."[22] It was still too early to know when deliveries might come through, so in the end, Wesson had to put Somervell off. On 23 December, he set dates for partial completion of three plants. One line at Radford was to be ready on 15 March; two lines at Indiana, on 1 April; and three lines at Kankakee, on 1 July. Wesson promised to have dates for all the plants on 1 March. Until then, he asked Somervell to continue building on a single-shift no overtime basis at all projects except Indiana, Radford, and Kankakee.[23]

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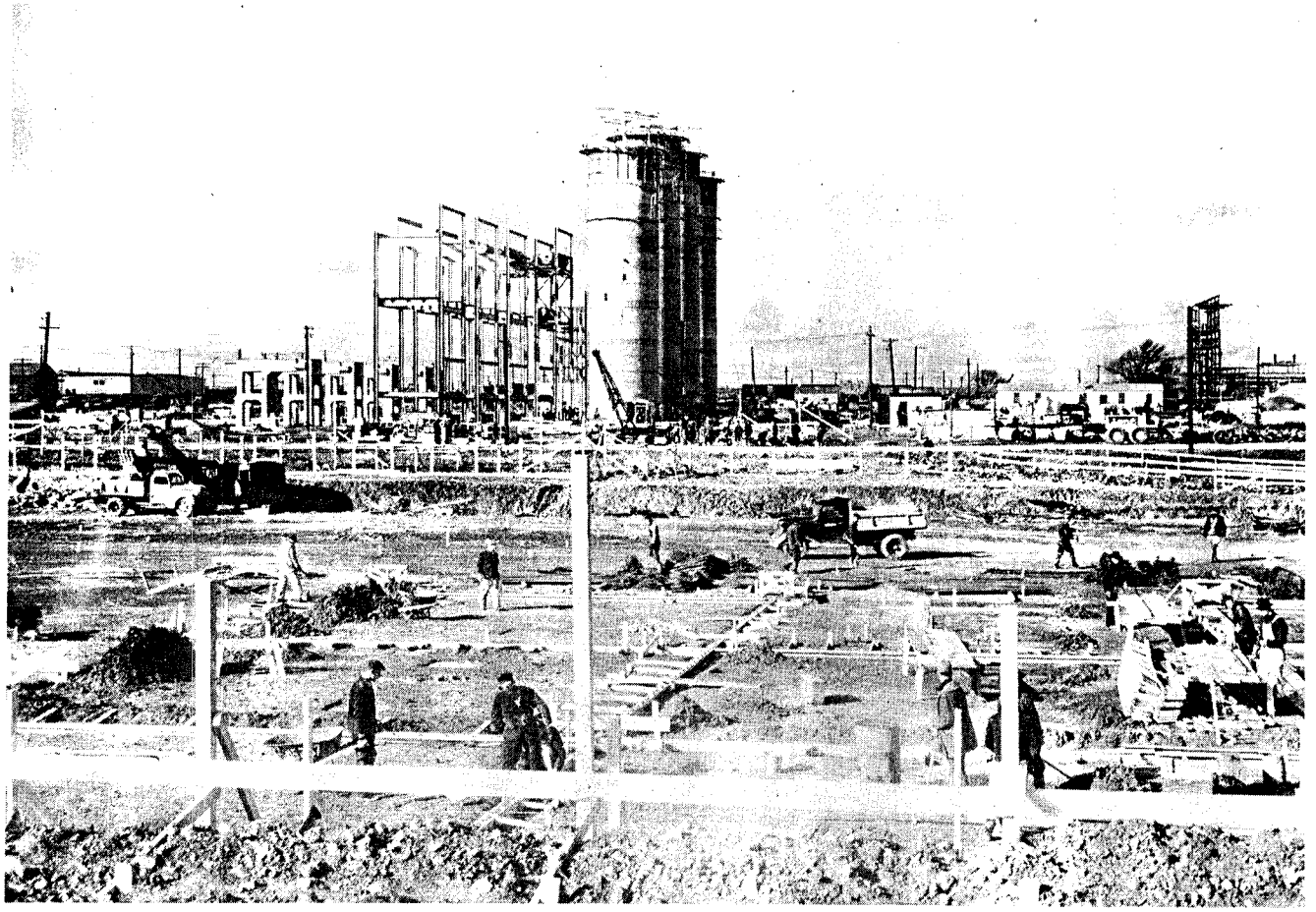
[19] Tel Conv, Campbell and Groves, 10 Dec 40. Opns Br Files, Ord.

[20] (1) Memo, Campbell for Groves, 13 Dec 40. (2) Memo, Groves for Campbell, 17 Dec 40. Both in QM 635 (Shops, Ord Repair) 1940. (3) OUSW, Summary of Constr Program for Manufacturing Facils (Rev 24 Jan 41). USW Files, Prodn Div 600.1–134 Constr (1 Jun 40–23 Mar 41). (4) Min, Mtg in Harris' Office, 5 Feb 41.

[21] Table compiled in EHD from Constr Progr Rpts and corresp files, Completion Dates and Progress—Ord Plants. EHD Files. Cited hereinafter as Table, EHD, Compl Dates and Progr—Ord Plants.

[22] Tel Conv, Groves and Campbell, 17 Dec 40. Opns Br Files, Ord.

[23] (1) Memo, Somervell for Styer, 26 Dec 40. Opns Br Files, Ord Projs. (2) Memo, Somervell for Patterson, 23 Apr 41. QM 635 (Ammo Plants) 1941.



CONSTRUCTION UNDER WAY AT INDIANA ORDNANCE WORKS, *1940.*

Wesson's choice of these three plants reflected the critical shortage of smokeless powder. The output of the single line at Radford would enable Frankford Arsenal, the Army's sole small arms ammunition factory, to increase production markedly. The two lines at Indiana would turn out twice as much cannon and small arms powder as the whole country had manufactured in 1940. But production of smokeless powder depended on the supply of DNT, one of its components. When it became apparent that commercial sources would not yield enough of this explosive to permit the lines at Radford and Indiana to operate at capacity, Ordnance focused its attention on Kankakee.[24] Campbell asked Groves to urge the contractor, Stone & Webster, to bend every effort toward completing one DNT line "at the earliest possible moment."[25] That the first rush order covered only three plants in no way reduced its importance.

Indiana and Radford presented little difficulty. Begun in September 1940, both were healthy projects and gave promise of meeting their deadlines. Creedon took nothing for granted, how-

[24] (1) Memo, Campbell for Somervell, 28 Dec 40. 635 (Radford OW) I. (2) Compl Rpt, Indiana OW, 6 Nov 42, p. 5. EHD Files.

[25] Memo, Campbell for Groves, 20 Dec 40. Ord 675/2218 (Misc).

ever, stating only that the jobs would be ready on time if everything went well. Virtually everything did. Threatened delays in deliveries of structural steel failed to materialize. Chartered trains brought additional workmen to Radford from Roanoke and Bluefield; the passengers paid forty cents per round trip and the government made up the difference in fare for the long distances involved. At Indiana, trailer camps provided attractive housing for workers. Operating three shifts and employing 20,000-man work forces, the projects moved along at a lively pace. By early February, Indiana was well ahead of schedule, and Radford, though somewhat behind, was making rapid gains.[26]

Kankakee was another story. Although the contract with Stone & Webster went into effect early, on 12 September 1940, the project experienced one delay after another. The land, acquired by a Chicago broker, did not become available until 21 November. Two days later a supplemental agreement doubled TNT capacity, tripled DNT, and added twelve tetryl lines. Not until December were designs far enough along for Stone & Webster to order materials. Building progress was slow. Recruitment proved difficult; the nearby Elwood plant had already exhausted the supply of skilled labor in the area, and workmen had to come from Chicago and other more distant points. Freezing temperatures hindered the work of building roads, digging foundations, and pouring concrete; only by using portable shelters and coke-fired salamanders and by performing extensive maintenance on equipment was the contractor able to avoid shutdowns. Frequent changes in layouts and designs played hob with orderly construction. Most serious, Stone & Webster had little luck in getting structural steel. Too many orders were ahead of Kankakee's at the mills. On 1 February the project was 6 percent complete, fifteen percentage points behind schedule. Finishing three lines by 1 July would take some doing. Ordnance therefore asked the contractor to rush one building which could serve temporarily as a DNT plant. Imposition of this additional requirement brought no lessening of pressure for completion of permanent lines.[27]

For the program generally, economy rather than speed became the overriding consideration. Groves' report of a $100-million deficit touched off an economy drive. On 8 January Campbell forbade the building of more brick dwellings at plants. Residents would enjoy "commodious and comfortable" frame houses but would have to do without tile bathrooms, slate roofs, and air-conditioning systems.[28] The savings involved were negligible, for the houses originally constructed were not luxurious by ordinary civilian standards.[29] Going a step further, Campbell on 16 January modified designs for administration buildings. "It is more desirable to effect economies," he wrote to Somervell, "than to have elaborate buildings." Two-story brick structures would give way to one-story frame

[26] (1) Compl Rpt, Indiana OW, 6 Nov 42, pp. 69–70, 74–81. (2) Compl Rpt, Radford OW, 1940–43, pp. 26–28. (3) Memo, Somervell for Campbell, 4 Jan 41. Opns Br Files, Radford OW. (4) Constr Div Progress Charts, 5 Feb 41, pp. 46–47.

[27] (1) Compl Rpt, Kankakee OW, 11 Aug 44, *passim*. EHD Files. (2) Constr Div Progress Charts, 5 Feb 41, p. 46.

[28] Memo, Somervell for general distribution, 8 Jan 41. QM 600.1 (Ord) 1941.

[29] Groves Comments, VIII, 5.

buildings.[30] Campbell must have felt that he was straining at gnats, for he sent Somervell a second memo the same day, urging "such steps to reduce the cost of construction [as] can be done without lessening the efficiency of the operation or safety of the plants." Since some of the projects were so far along that changes might cause delays, Campbell asked Somervell to rely on his own judgment in deciding where to cut.[31]

Wasting little time on formalities, Somervell sent Campbell the terse reply, "Your desires in this matter will be carried out."[32] Meanwhile, he summoned Colonel Leavey.[33] Within a day or so the two Engineers had mapped a campaign. Somervell sent a scorching memorandum to the field. There had, he said, been "a leaning toward grandeur." Stressing the need for simplicity, efficiency, and economy, he wrote:

> There is no excuse for masonry structures, monumental or otherwise, where a light frame structure will serve the purpose. There is no excuse for the use of expensive materials where less costly ones will serve the purpose for the period of time for which the construction is being provided. There is no excuse for a heavy duty road where a lighter type will . . . provide for anticipated traffic with reasonable maintenance costs. There is no need to design railroads for a speed of 90 miles an hour within the confines of a . . . manufacturing plant.

He enjoined architect-engineers to cheapen designs as much as they felt advisable, and promised that if operators balked, he would personally take a hand.[34] Following on the heels of Somervell's memorandum were orders to each of the projects instructing commanding officers and Constructing Quartermasters to survey all plans with a view to scrapping unnecessary items and reducing costs.[35]

Ordnance, continuing meanwhile to seek additional economies, discovered that material savings might result from changes in layout as well as in design. According to General Campbell, important savings could "be had in the basic layout of the plant with particular respect to the locations of the various elements comprising the plant." He recognized, however, that design and construction had been under way too long on some plants to permit economical changes in layout. He nevertheless asked commanding officers to cut corners wherever they could without hurting progress.[36]

On 18 January, in a far more drastic step, Campbell ordered a fundamental change in plans for many late projects. Scrapping blueprints for permanent facilities, he switched to temporary plants designed for a 5-year life. To be built on the new model were eight projects, including all bag loaders and late shell loading, TNT, and powder plants.[37] Advising Constructing Quartermasters of Campbell's decision, Somervell warned

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[30] Memo, Campbell for Somervell, 16 Jan 41. QM 631 (Admin Bldgs) 1940.

[31] Memo, Campbell for Somervell, 16 Jan 41. Opns Br Files, Ord Projs.

[32] Memo, Somervell for Campbell, 17 Jan 41. Opns Br Files, Ord Projs.

[33] Memo, Styer for Somervell, 17 Jan 41. Same File.

[34] OQMG Constr Div Ltr 27, 21 Jan 41. EHD Files.

[35] (1) Ltr, Campbell to CO Lake City OP, 28 Jan 41. 635 (Lake City OP) I. (2) Ltr, Campbell to CO's various plants, 4 Feb 41. Ord 675/3373 (Misc). (3) Ltr, Constr Div to ZCQM's, 8 Feb 41. QM 635 (ZCQM 5).

[36] Ltr, Campbell to CO's various plants, 28 Jan 41. Ord 675/4949 (Weldon Spring).

[37] Memo, Campbell for Somervell, 18 Jan 41. 635 (Ord Clipping, Belting & Linking Bldgs—Small Arms Ammo).

that complications might arise if drawings for permanent buildings were complete or nearly so, if large quantities of materials were on order, or if construction had already begun.[38] He told his representatives to use good judgment but to spare no reasonable effort to "effect economies and keep costs to a minimum" at the eight plants.[39] Some of the other late starters, the Denver small arms ammunition plant, for example, would have auxiliary buildings of 5-year type but would use plans developed earlier at Lake City for manufacturing units and utilities. Somervell made certain, however, that permanent structures at Denver would have no "gold-plated clocks or other such embellishments."[40]

The costs-reduction drive undoubtedly saved money, though it was difficult to tell how much. At the early, first-wave plants, it eliminated many expensive features. Hospitals, fire houses, police stations, and telephone exchanges went the way of brick residences and administration buildings. Useful but nonessential structures, such as tool and gage shops, became things of the past. Commanding officers and Constructing Quartermasters sought new ways to cut costs. At Lake City, for instance, the officers in charge cheapened the design of nine buildings, lowered specifications for roads, walks, and lighting, and postponed landscaping. The temporary, 5-year plants were even more spartan; so substantial were the savings, that Campbell adopted the 5-year type as standard.[41] After early 1941 the trend in industrial construction was toward ever greater austerity.

Lacking money for overtime and other costly expedients, Somervell tried by other means to push the entire program. Contractors whose projects lagged received a "pep" letter.

> A bridge completed after a battle is over may be a marvel of engineering skill and ingenuity [the message read], but it is *absolutely worthless* for the purpose for which it is intended. The United States mean to arm for defense—the determination of their people is unequivocal. Your work will determine the speed with which additional forces can become effective. You are the country's agent. Immediate and telling action on your part is necessary to place your project on the most efficient basis. *RESULTS MUST BE SECURED.*[42]

Meantime, Groves called two regional conferences of design consultants, contractors, architect-engineers, and CQM's —one at Washington on 20 December, the other at St. Louis on 6 January. At these gatherings he attempted to clear up misunderstandings and explain instructions. But above all he emphasized the importance of completing plants "with satisfactory operating characteristics" at "the earliest practicable" time.[43]

While exerting pressure on the field, Somervell and his staff tried to get the

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[38] Memo, Somervell for CQM Alabama OW, 23 Jan 41. Same File.

[39] Ltr, Somervell to CQM Wolf Creek OP, 27 Jan 41. 635 (Wolf Creek OP) I.

[40] Ltr, Somervell to ZCQM 8, 26 Feb 41. 635 (Denver OP) I.

[41] (1) Ltr, Campbell to CO's Loading Plants, 7 Feb 41. QM 635 (Loading Plants) 1941. (2) Ltr, Somervell to ZCQM 7, 8 Feb 41. 635 (Iowa OP) I. (3) 1st Ind, 8 Feb 41, on Ltr, Campbell to CO Lake City OP, 28 Jan 41. 635 (Lake City OP) I. (4) Ltr, Cof-Ord to Patterson, 9 Jun 41. USW Files, 004.404 (Plants, Ord and Muns).

[42] Ltr, Somervell to E. I. DuPont de Nemours & Co, Indiana OW, 23 Dec 40. 600.914 (Indiana OW). See also Folder, Lt Gen Somervell in EHD Files.

[43] Notes for Mtgs of Design Consultants, etc., 20 Dec 40, 6 Jan 41. Opns Br Files, Gen, December 16, 1940–June 2, 1941.

remaining first-wave projects under way. As the using services settled questions of requirements and plant location, orders for construction came through. Seven new directives, one in December, three in January, and three in February—added to the backlog inherited from Hartman—brought to twenty the number of jobs for which Somervell had to negotiate contracts. Although he signed but one agreement in December, he completed arrangements for 6 projects in January, 8 in February, and 3 in March. Meanwhile, the number of going projects rose. By late January, 23 were building; by late March 33.[44]

By tightening control over the projects, Groves hoped to eliminate confusion and delays. As far back as November 1940, he had started strengthening the Quartermaster position in the field. Shortly after his appointment to the Fixed Fee Branch, Quartermaster officers took charge of construction at the Iowa shell loading plant, Lake City small arms ammunition plant, and Weldon Spring explosives plant. Early in December, Groves told Campbell, "There is little detailing of Ordnance officers on the job as Constructing Quartermasters."[45] But Campbell was also moving to strengthen his position. In mid-December he insisted on placing his representatives as CQM's at the Morgantown ammonia plant and the Jefferson Proving Ground. Then, a few days after Christmas, he suggested that commanding officers take over as CQM's at all large munitions projects, old and new. Neither Groves nor Somervell was willing to go along. Although they made some concessions—commanding officers served as CQM's at five of the late plants, New River, Wolf Creek, Alabama, Hoosier, and Ohio River—they held on to going projects already under their control and took charge at most new ones.[46]

Increasingly, the Construction Division asserted its authority. In late December Somervell and Campbell sent commanding officers at powder and explosives plants the following joint statement: "You must realize the fact that the Quartermaster Corps is charged by law with all construction activities. Equally, you must recognize that the Ordnance Department occupies the position of a client in private construction work."[47] Six weeks later, in a circular to the field, Somervell took a stronger line. The Constructing Quartermaster was "the official in responsible charge"—"the authorized representative of the Government on the project." As such, he controlled the architect-engineer and constructor. Although the wishes of the operator and the commanding officer would be "fully considered at all times," their needs would "be communicated to and carried out on the project through the Constructing Quartermaster." The quartermaster zones would referee disputes. The document made it clear that the CQM was headman at the project and that his decisions were subject to review only by his superiors in the Quartermaster Corps.[48]

[44] Constr PR's 15, 19 Apr 41; 40, 30 Nov 41.

[45] Tel Conv, Campbell and Groves, 7 Dec 40. Opns Br Files, Ord.

[46] (1) Data compiled from EHD Files, Industrial Projs. (2) Memo, Campbell for Groves, 27 Dec 40. QM 210.213 1940. (3) Opns Br Files, Ord Corresp.

[47] Ltr, Somervell and Campbell to CO's Powder and Explosive Plants, 30 Dec 40. Opns Br Files, Ord Corresp.

[48] OQMG Constr Div Ltr 101, 19 Feb 41. EHD Files.

GENERAL GRANT (M3) ROLLS OFF ASSEMBLY LINE, *Detroit Tank Arsenal, Michigan.*

As it solidified its position, the Construction Division pledged co-operation with the using services. At his meetings with project representatives, Groves defined the builder-user relationship as "a partnership" and emphasized the "paramount importance" of "close co-operation."[49] Privately, he instructed CQM's to be tactful in their dealings with commanding officers. "I expect my people to do the getting along," he told his man at Weldon Spring. "I would like very much to have you go the limit on the idea of cooperation."[50] In this way Groves was able to get along with his "clients"—Ordnance and Chemical Warfare. Campbell afterward commented: "Groves was an exceptionally reasonable man to deal with and had a full conception of the *object* of building the plants. The buildings were merely to house the equipment used to produce munitions required to win the war."[51]

Progress reports reflected improved co-ordination and more unified direction. Between 6 January and 8 February most of the projects launched in the summer and early fall of 1940 made substantial gains. On thermometer charts maintained by Major Robinson in the Control Section, the Philadelphia Armor Plate Plant shot up 29 percentage points; the Springfield Armory, 39; and the Detroit Tank Arsenal, 47. Other early starters—Edgewood, Elwood, Frankford, Gadsden, Picatinny, and Radford— advanced an average of 11 percentage points during this period. At newer projects progress was understandably slower, for the first steps in construction were those most seriously impeded by winter weather. Nevertheless, all of the eleven projects started between mid-December and early February were on schedule by 1 March. Except for one or two trouble spots, the program seemed in good condition.[52]

During the late winter and early spring of 1941, five plants started producing. On 20 February Fred T. Ley & Company completed work on the new M1 rifle plant at Springfield Armory. Early in March the first smokeless powder line at Radford went into operation, and on the 14th General Gregory shared the speaker's rostrum at dedication ceremonies with General Wesson, Judge Patterson, and Governor James H. Price of Virginia. On 15 March, the Philadel-

[49] Notes for Mtgs of Design Consultants, etc., 20 Dec 40, 6 Jan 41.

[50] Tel Conv, Groves and Lt Col Clyde L. Miller, 13 Jan 41. Opns Br Files, Weldon Spring OW.

[51] Comments of Gen Campbell on Constr MS, VIII, 58.

[52] Constr Div Progress Charts, Jan–Mar 41. EHD Files.

phia Armor Plate Plant reached completion. In April the Indiana Ordnance Works produced its first powder and the Detroit Arsenal, its first tank.[53] Considering the season of the year when much of the work went forward and the lack of funds for expediting three of the five projects, the opening of these plants was a notable achievement.

Describing construction "as a miracle of performance," General Campbell cited the example of the Detroit Tank Arsenal.[54] Designed and built by the Chrysler Corporation and Albert Kahn Associates, the arsenal was the first plant in the United States to mass produce tanks. On 11 September 1940 Kahn broke ground for the main assembly building, a huge steel and glass structure, five blocks long and two blocks wide. The scheduled completion date was 31 March 1942. There was some friction at first, as the Constructing Quartermaster, an Ordnance officer, rubbed Kahn the wrong way. On 11 October Hartman relieved the CQM and replaced him with Major Kadlec. Working in harmony, Chrysler, Kahn, and Kadlec forced construction at top speed. On 18 November erection of structural steel began. Work went forward in the bitter cold of the hard Detroit winter. By 28 January the steel members were all in place and half the structure was glassed in. At this point the contractor closed off the completed portion of the building with temporary partitions, so that he could lay concrete flooring and install heavy machine tools. Steam locomotives furnished heat. Fifteen hundred workmen maintained a lively pace. By mid-April 1941 the principal manufacturing units were ready. On the 24th Chrysler formally presented its first tank to General Wesson.[55] Campbell, who attended the presentation ceremonies, later wrote: "The first two tanks rolled out the back door. The steam was provided by two old locomotives which had been run into the shop. Some of the outside walls were of canvas tarpaulin and yet, with the indomitable spirit of all connected, this great job had been done."[56]

More miracles and more indomitable spirit were needful. In the spring of 1941 only a small part of the program was complete. The Army faced new and exigent demands on the munitions front. Pressure for speed was mounting.

Demands for Greater Speed

During the winter of 1940–41, rearmament entered a more critical phase, as the nation assumed new risks and fresh responsibilities. After his re-election, President Roosevelt took bold and forceful measures to assure America's security and Great Britain's survival. On 29 December 1940, in a significant and memorable address, he made common cause with Britain and called upon this country to become the "Arsenal of Democracy."[57] Three days later, in his State of the

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[53] (1) Constr Div OQMG, Constr Contracts Awarded or Approved, 12 Nov 41, pp. 9, 37. (2) Compl Rpt, Radford OW, 1940–43, p. 28. (3) Compl Rpt, Indiana OW, 6 Nov 42, p. 81. (4) Rpt, Activities of Constr Div, Jul 40–Nov 41, pp. 216, 198.

[54] Ltr, Campbell to OCMH, 10 Mar 55.

[55] (1) Ltr, ZCQM 6 to OQMG, 25 Apr 41. EHD Files. (2) Ltr, CQM Detroit Tank Arsenal to OQMG, 19 May 41. EHD Files. (3) Comments of Gen Campbell on Constr MS, VIII, 66. (4) Lt. Gen. Levin H. Campbell, Jr., *The Industry-Ordnance Team* (New York: Whittlesey House, 1946), pp. 109–10.

[56] Ltr, Campbell to OCMH, 10 Mar 55.

[57] *Public Papers and Addresses*, IX (1940), 633ff.

Union message, he announced the policy:

> We are committed to an all-inclusive national defense.
>
> We are committed to full support of all those resolute peoples, everywhere, who are resisting aggression and are thereby keeping war away from our Hemisphere.
>
> We are committed to the proposition that principles of morality and considerations for our own security will never permit us to acquiesce in a peace dictated by aggressors and sponsored by appeasers.[58]

Congress affirmed this policy by passing the Lend-Lease Act of March 11, 1941, which, in Stimson's words, "established between us and the nations fighting Hitler . . . a relation which was not substantially dissimilar to that which would have existed had their fighting forces been our own expeditionary fighting forces and we their base or arsenal."[59] The new commitments and the dangers they entailed required major readjustments in military goals. Plans took shape for a second wave of munitions plants. Meanwhile, Ordnance and construction officers intensified their efforts to expedite completion of first-wave projects.

The long-awaited schedule of Ordnance completion dates, which Campbell gave to Somervell on 28 February 1941, reflected Roosevelt's urgent demand for "more of everything."[60] Listing seventeen plants, the schedule resembled the one established earlier for Indiana, Radford, and Kankakee. That is, it set time limits for construction of each production unit, such as a single powder or TNT line. Completed units would operate while construction continued on remaining ones. The list included two dates for each unit, "A" or desirable and "B" or essential. Thus, the "A" schedule for the third and fourth TNT lines at Kankakee was 1 July 1941; the "B" schedule, 1 October. The entire plant was to be ready on 1 December or 31 December, the "A" and "B" dates for the last tetryl lines. While Somervell was happy to have firm target dates at last, the dates themselves raised problems, for Ordnance was in effect calling for a speedup in munitions plant construction.[61]

Before accepting the schedule, Somervell wanted answers to two questions: were the dates feasible and how much would it cost to meet them. Polling the contractors, Groves got a mixed reaction. Six sent favorable replies: Coosa River, a bag loader, Weldon Spring, Radford, Ravenna, Kingsbury, and Iowa could meet the "A" schedule without added cost. Two projects, Indiana and New River, could satisfy the "B" schedule without any trouble or extra expense but would need more money to meet the "A" dates. "We will make every effort to meet the desired dates," explained DuPont's representative at Indiana, "but . . . it will be necessary to work overtime and Sundays . . . and to spend additional funds for betterment of present material delivery dates, which in some cases may not be able to be improved."[62] From the Wolf Creek shell loading plant came the puzzling reply: either schedule was possible with another $5 million. Contractors at the Hoosier plant despaired of

[58] *Ibid.*, pp. 666–67.

[59] *Report of the Secretary of War . . . 1941*, p. 7.

[60] *Public Papers and Addresses*, IX (1940), 642.

[61] (1) Memo, Campbell for Somervell, 28 Feb 41. Ord 675/4276. (2) Min, Constr Div Staff Mtg, 7 Mar 41. EHD Files. (3) Ltr, Farrell to CQM Kankakee OW, 4 Mar 41. 600.914 (Kankakee OW) I.

[62] Ltr, E. I. DuPont de Nemours & Co., Charlestown, Ind., to CQM Indiana OW, 18 Mar 41. 635 (Indiana OW) I.

meeting "A" dates but felt that an additional $4,244,000 might enable them to keep to the "B" schedule. The seven remaining projects offered no assurances whatever. The Alabama powder plant, Ohio River ammonia plant, and Plum Brook TNT plant could furnish no answers at all. At Kankakee, Elwood, and the Baytown toluol plant, completion would depend on deliveries of materials and processing equipment. The case of the Morgantown ammonia plant seemed hopeless; the contract had called for completion in May 1942 and Ordnance was now demanding that production begin in September 1941.[63] When all replies were in, Groves laid the facts before Campbell. Final decision was up to Patterson, who, as Assistant Secretary of War until April 1941 and as Under Secretary thereafter, administered funds for expediting production.[64]

On 1 April Campbell forwarded a new schedule for a dozen plants. The dates indicated that Patterson had loosened the purse strings slightly but was unwilling to empty the purse. "A" schedules would apply to five of the six projects which would require no additional funds. Because Coosa River was still in preliminary stages, decision on that project remained up in the air. Deadlines for Alabama, Hoosier, New River, and Ohio River were also in abeyance. Indiana received an additional $3.2 million to enable DuPont to meet the "A" schedule. "B" schedules would have to suffice for most of the remaining plants. Indeed, Wolf Creek got an additional two months, its final completion date moving from October to December 1941. Morgantown continued to pose a problem. Although Groves said that the "A" date, 1 September, was patently impossible, Campbell insisted "that every effort be made towards meeting the September first date in view of the urgent requirements for Ammonia." Groves accepted the September date reluctantly, complaining, "This will undoubtedly result in continued reports of 'behind schedule' for the Ammonia Plant at Morgantown."[65] Somervell appeared more confident. "Ordnance has been very cooperative in figuring dates for us to meet," he told a conference of zone Constructing Quartermasters early in April. "None of them seem to be dates that we cannot meet if the jobs are conducted reasonably well."[66]

While the Ordnance schedule was under revision, the Chemical Warfare Service was setting new requirements. The five Chemical Warfare projects, which had previously carried no completion dates, suddenly received relatively close deadlines. Edgewood Arsenal was down for 1 September 1941. The impregnite plants at Niagara Falls, New York, East St. Louis, Illinois, and Midland, Michigan, all started in February, were to be ready by October. The charcoal-whetlerite plant at Fostoria, Ohio, not yet under way, was due for completion early in 1942. In addition, on 1 March 1941 Chemical Warfare requested construction of four clothing renovation plants. To occupy government-owned land near Quartermaster depots at Columbus, Ohio, Kansas City, Missouri, New Cumberland, Pennsylvania, and Ogden, Utah, the plants had price tags

[63] Memo and Incl, Groves for Somervell, 16 Apr 41. Opns Br Files, Ord Corresp.

[64] WD Orders, 21 Apr 41.

[65] Memo, Groves for Somervell, 16 Apr 41.

[66] Min, Conf of ZCQM's, 7–10 Apr 41, p. 23. EHD Files.

of $322,600 each. The "desired" completion date was 1 July 1941; the "essential" date, 1 August.[67] Comparatively small though they were, Chemical Warfare requirements added to the ever-growing construction burden.

Pressure was developing for a drastic speedup of the small arms ammunition projects. By early 1941 the demand for rifle ammunition was rising sharply as more and more troops entered training. Ordnance reserves, already depleted by large shipments to Great Britain, were dwindling rapidly. Frankford Arsenal had increased its production but could not possibly cope with the growing shortage. The new small arms ammunition plants had been planned as long-term projects. On 1 March 1941, Lake City carried a tentative completion date of 27 November 1941; St. Louis, a date of 1 April 1942; and Denver, where construction had not yet started, no date at all.[68] Early completion of these three plants was imperative. "The shortage of small arms ammunition," Groves later wrote, "and the terrific shortage which would occur in the event we were attacked was a matter of serious concern to Campbell, Somervell, and myself. I am sure that it must have been in the mind of Wesson." Campbell and Somervell talked to Patterson about the situation.[69] On 7 April representatives of Ordnance, OPM, and the Under Secretary's office agreed to try to obtain processing equipment for the plants by 30 September.[70] A week later the drive was on.

Patterson impressed upon all concerned the urgent necessity for finishing the plants by 30 September. On 15 April he directed Gregory "to take any and all steps necessary to see that construction work on these projects is completed by that date."[71] On 16 April he told an official of the Remington Arms Company, operators at Lake City and Denver, that the President was worried over the outlook for production of small arms ammunition.[72] "We will not be in good shape," said Patterson, "until the three new plants get into operation." He asked Wesson and Gregory to station their "most capable and energetic officers" at the projects, to pay close attention to progress, and to do everything within their power to hasten deliveries of processing machinery. Since St. Louis was the weakest of the projects, he asked Wesson to make certain that the operator, the Western Cartridge Company, clearly understood "the seriousness of our predicament."[73] But in urging these measures, Patterson did not attempt to tell Somervell how to meet the deadlines.

As soon as they got the green light, Groves and Creedon went into action.

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[67] (1) Constr PR's, Jan–Apr 41. EHD Files. (2) EHD, Construction of Chemical Warfare Facilities (MS), 1944, p. 4. (3) Leo P. Brophy, Wyndham D. Miles, and Rexmond C. Cochrane, *The Chemical Warfare Service: From Laboratory to Field*, UNITED STATES ARMY IN WORLD WAR II (Washington, 1959), pp. 254–56.

[68] (1) Thomson and Mayo, *Ordnance Procurement and Supply*, pp. 190–91, 195. (2) Table, EHD, Compl Dates and Progress—Ord Plants.

[69] Groves Comments, VIII, 8–9.

[70] Memo, OCofOrd for Masson Britton, OPM, 11 Apr 41. USW Files, Misc & Sub—Ammunitions thru Dec 41.

[71] Memo, Patterson for Gregory, 15 Apr 41. QM 635 (Ammo Plants) 1941.

[72] Ltr, Patterson to D. F. Carpenter, Remington Arms Co., 16 Apr 41. USW Files, 095 (Remington Arms Co).

[73] Memo, Patterson for Wesson and Gregory, 19 Apr 41. QM 635 (Ammo Plants) 1941.

They sent orders to Constructing Quartermasters, instructing them to "push the work . . . to the maximum extent possible consistent with orderly procedure." They authorized extra shifts and overtime.[74] And they told architects to forget about aesthetics. "I personally don't care what the thing looks like . . . ," Groves informed one CQM, "as long as we get it finished."[75] Creedon, taking every possible precaution against delays, meanwhile gave particular attention to steel.[76] By late April Somervell felt the division was doing all it could to expedite construction. "Provided no delivery difficulties are encountered with respect to materials, especially steel," he advised Campbell, the new deadlines would be met.[77]

At the outset, Somervell had warned that the ammunition speedup would be costly—a sure-fire prediction. A survey of the projects showed that an additional $29 million would be necessary. The bulk of it, $21.5 million, would go for increased payrolls—overtime, extra shifts, and enlarged work forces; the remainder, for premiums for quick deliveries and for salaries of expediters and followup men. St. Louis, where union rules prescribed heavy premiums for overtime and shift work, would claim the lion's share, $12 million. Lake City would require $9 million and Denver $8 million. The total was large but Patterson did not hesitate. The money was soon forthcoming.[78]

The speedup of small arms ammunition plants was only the beginning. Somervell was certain of that. He saw the day fast approaching when "the heat" would be off the housing program and on all the plants instead. Early in April he predicted: "By next summer the people are going to start worrying about the powder and shot for the brave boys and not so much about the brave boys who will be supplied with everything up to a powder puff to take care of themselves." Holding that "the time to get ahead is the first half of a job and not the last half," he insisted on greater speed at all munitions projects.[79] He ordered his staff to hunt out bottlenecks and break them. He brought pressure on Ordnance to hasten selection of the two or three remaining sites and on Patterson to expedite approval of the several late contracts. He ordered zone Constructing Quartermasters to put their most competent engineers on Ordnance projects.[80] For his part, Groves tried to get the projects in shape for the big push he knew was coming. Explaining that it would be "embarrassing . . . to wait and then find out it was too late to speed up," he told a member of Patterson's staff: "We are going ahead on the basis of seeing that every one of [the plant projects] is in condition so that we can step it up. The few that are behind now, we are starting to spend a little extra and go into a certain amount of overtime so

[74] Ltr, Groves to CQM St. Louis OP, 24 Apr 41. Opns Br Files, St. Louis OP—Corresp.

[75] Tel Conv, Groves and CQM St. Louis OP, 30 Apr 41. Same File.

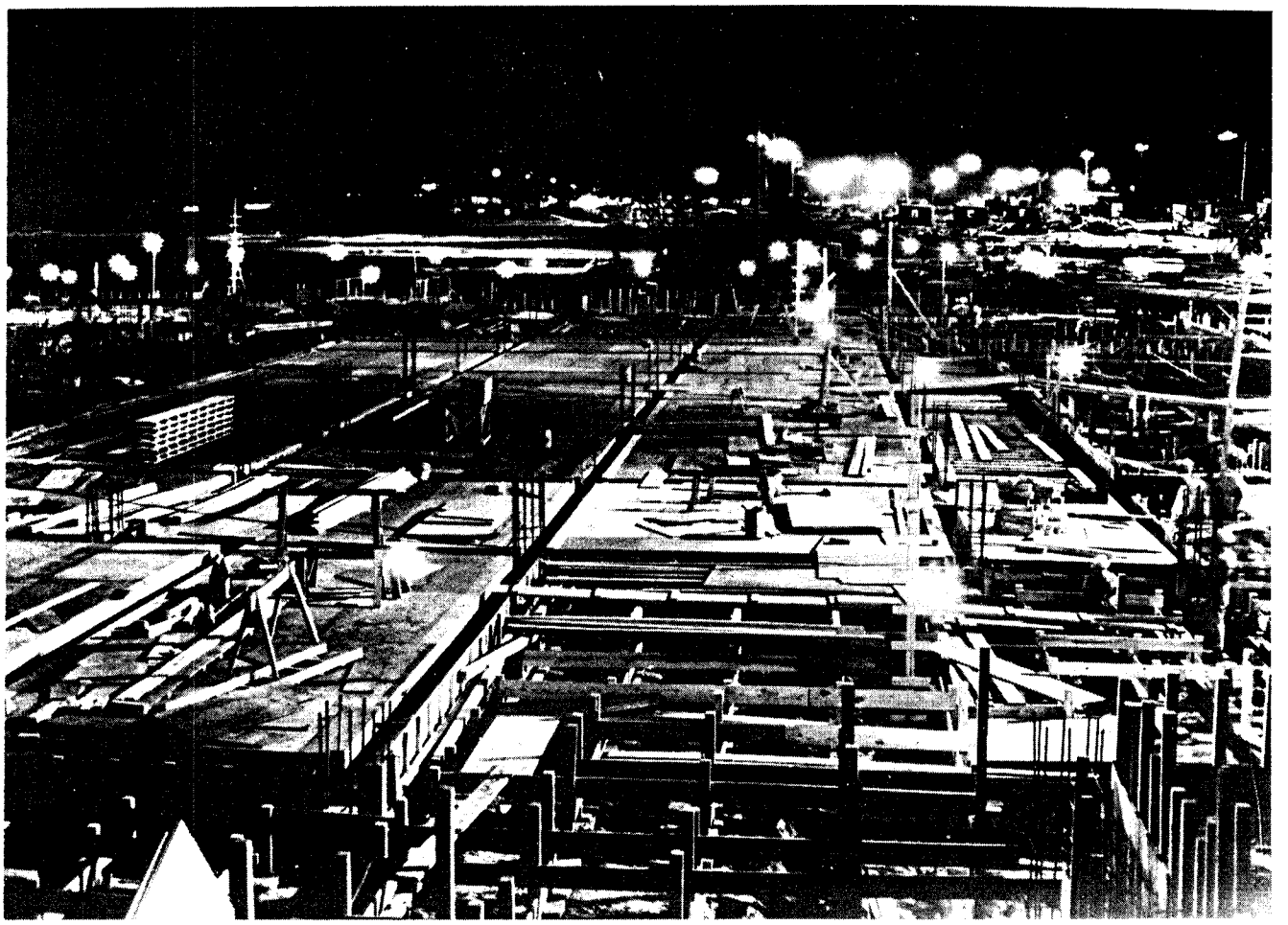
[76] Notes of Conf, Creedon, Wilson, and Reps of various steel companies, 28 Apr 41. Same File.

[77] Memo, Somervell for Campbell, 21 Apr 41. QM 635 (Ammo Plants) 1941.

[78] (1) Ltr, OCofOrd to WD Facils Bd, 5 May 41. Ord 675/7222 Misc. (2) Memo, OCofOrd Fiscal O for Campbell, 23 May 41. Ord 675/8381 Misc. (3) Memo, Patterson for NDAC, 14 May 41. USW Files, Misc & Sub—Ammunitions thru Dec 41.

[79] Min, Conf of ZCQM's, 7–10 Apr 41, pp. 248, 23.

[80] Min, Constr Div Staff Mtgs, 7, 14 Mar 41.



NIGHT SHIFT AT WORK, ST. LOUIS ORDNANCE PLANT

that we will be prepared to expedite them when the time comes."[81] As long as funds were lacking for an all-out drive, there was little else Somervell could do.

Late in April he tried to speed up the whole munitions program. In two memorandums for Patterson on the 23d, he announced his intention to expedite all industrial jobs. Only a few days earlier, General Gregory had received instructions to hasten completion of an armor piercing core plant next door to the St. Louis small arms ammunition plant. Ordnance had taken the first action leading to construction of this project late in February and was now calling for completion on 1 June. The best date Somervell could promise was 30 September. Similar rush orders for other plants might be forthcoming at any time. To avoid being caught off guard, Somervell proposed to put in overtime and extra shifts at all the projects and, in fact, had already issued orders to that effect. He furnished the draft of a letter from the Under Secretary to Knudsen, strongly urging that all Ordnance and Chemical Warfare projects have first priority. The increased speed, Somervell informed Patterson, would up construction costs 25 or 35 percent. More exact

[81] Tel Conv, Groves and Spalding, OUSW, 24 Apr 41. Opns Br Files, Ord.

estimates would be available within a month.[82]

The bid failed. On 24 April Brig. Gen. Sidney P. Spalding, director of the Production Branch, OUSW, gave Groves the bad news. The previous evening Patterson had brought Somervell's memos to Spalding's office, and after talking the matter over, had decided not to send the letter to Knudsen. "At least," said Spalding, "we weren't ready to go ahead on any of the others except the small arms ammunition plants and . . . we would check up and let him [Somervell] know shortly about the remaining plants." Spalding was studying each of the projects to see "whether we are justified in spending a good deal of money on speeding them up."[83] Apparently, he failed to find sufficient justification. On 30 April Patterson ruled out any crash effort on the Chemical Warfare plants. A week later he told Somervell to limit the speedup to small arms ammunition.[84]

This limitation held for another month. Then came the long-anticipated change. On 27 May 1941 the President proclaimed an unlimited national emergency and called for "the strengthening of our defense to the extreme limit of our national power and authority."[85] Two weeks later General Wesson recommended that Patterson scrap existing schedules and direct Gregory to complete the first-wave projects at the earliest possible date. "Furthermore," Wesson wrote, "to the extent that additional overall expense may be involved in expediting the completion of this work, I recommend that authority be given the Quartermaster General to exercise his judgment in this connection." Patterson concurred.[86] Speed was all-important. The time lost in efforts to economize was beyond recall. The Army had to make the most of whatever time remained.

The Steel Shortage

The greatest obstacle to early completion was the shortage of steel. Unlike camps and cantonments, which were largely of wood, munitions plants and depots required huge quantities of steel. Manufacturing buildings were usually steel fireproof structures on reinforced concrete foundations. Doors and window sash were of steel, as was much of the processing pipe that honeycombed the buildings. Steel was a major component of magazines and igloos for storing explosives and also of inert storage warehouses, laboratories, water and power plants, and industrial sewage systems. Many miles of railroad tracks crisscrossed the sites: the Iowa plant had 96 miles; the Elwood plant, 100. Seven-foot chain link fences strung on steel posts enclosed maximum security areas. The Umatilla Ordnance Depot had 20 miles of this fencing; the Radford Ordnance Works, 23.8 miles. Among the iron and steel products that went into the Indiana smokeless powder plant were 16,471 tons of structural steel; 8,737 tons of reinforcing rods; 440 tons of reinforcing mesh;

[82] (1) Memo, Somervell for Patterson, 23 Apr 41, and Incl. QM 635 (Ammo Plants) 1941. (2) Memo, Somervell for Patterson, 23 Apr 41. QM 635 (CWS) 1941.

[83] Tel Conv, Spalding and Groves, 24 Apr 41. Opns Br Files, Ord.

[84] (1) 1st Ind, 30 Apr 41, on Memo, Somervell for Patterson, 23 Apr 41. QM 635 (CWS) 1941. (2) Memo, OUSW for Somervell, 7 May 41. QM 635 (Ammo Plants) 1941.

[85] *Public Papers and Addresses*, X (1941), 193.

[86] Memo, Wesson for Patterson, 9 Jun 41, and approval thereon. Opns Br Files, Equip 1.

7,746 squares of corrugated iron; 185,001 square feet of steel sash; 2,401 tons of steel pipe supports; 17.53 miles of chain link fencing; and rails for 67.6 miles of tracks. The switch to 5-year life design early in 1941 reduced, but by no means eliminated, requirements for steel.[87]

Where steel was concerned, the priorities system tended to work against, rather than for, munitions projects. Civilian production agencies were slow to assist the projects. Priorities for plants and depots were consistently too low and too late. Moreover, steel did not go on the Critical List until May 1941. No priority ratings were applicable to steel before that time. Not until the fall of 1941 did production authorities take steps to curtail use of critical materials in nonessential construction. Throughout most of the last year of peace, vast tonnages of steel went to civilian construction, while defense agencies competed among themselves for part of the industry's product.[88] Six months after Pearl Harbor, a Senate committee reported:

> In the year 1941 approximately $11,600,000,000 was expended for new construction. Of this amount almost $4,000,000,000 represented construction for nondefense purposes. The industry consumed about 15,000,000 tons of steel ingot in this year, over 7,000,000 of which went into construction for nondefense purposes.[89]

One of the first projects to feel the pinch was Kankakee. In January 1941, soon after Ordnance set the July deadline for the first three production units, Stone & Webster reported that the mills could not promise structural steel in time to meet the schedule. The contractors appealed to Creedon for a blanket priority. Because the ANMB had yet to approve priority ratings for construction jobs, Creedon had to refuse. In any case, priorities applied only to items on the Critical List and steel was not among them. By paying premium prices for warehouse stocks, the contractors secured about half the needed steel. Meanwhile, they continued to press for priority assistance. In mid-February Groves asked ANMB to assign the project a high priority, but the board turned him down. Major Wilson tried pressuring the mills but with little effect. The project wobbled along until late March, when it was rated A–1–b. But since steel was not subject to production controls, the rating was of little help.[90]

Gradually the shortage spread. On 19 February, Major Wilson gave Patterson a list of sixteen munitions projects at which steel was critical. Thus far, he advised the Assistant Secretary, few contractors had encountered serious delays in obtaining structural shapes, but he warned that the situation might soon take a turn for the worse. During February and March the number of jobs held up awaiting shipments of steel crept higher. Deliveries of structural shapes were two to four months after order. Rail was increasingly hard to get and corrugated iron was becoming scarce.

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[87] (1) Rpt, Activities of the Constr Div, Jul 40–Nov 41, pp. 196–238. (2) Compl Rpt, Indiana OW, 6 Nov 42, p. 337. (3) Compl Rpts, various other projects.

[88] For a general discussion of the workings of the priorities system see: Smith, *The Army and Economic Mobilization*, chs. XXII, XXIII.

[89] S Rpt 480, Part 8 (1942), p. 12.

[90] (1) Memo, OCofOrd for OQMG, 29 Jan 41. 635 (Kankakee OW) I. (2) Compl Rpt, Kankakee OW, 11 Aug 44, Secs 5.305 and 5.307. (3) Ltr, Stone & Webster to Creedon, 11 Feb 41. 601.1 (Kankakee OW) III. (4) 600.914 (Kankakee OW) I. (5) Ltr, OQMG to Stone & Webster, 1 Apr 41. QM 161 (E. I. DuPont de Nemours Co.).

When, on 1 April, seven Ordnance projects received closer deadlines, vigorous action followed to hasten deliveries of steel. Contractors paid large premiums for warehouse stocks. Troubleshooters intensified their efforts. At the Indiana Ordnance Works, DuPont enlarged its "Urging Department" to 52 persons.[91] Then came the mid-April speedup of small arms ammunition projects.

Whether the plants could be complete by 30 September would depend primarily on supplies of structural steel. When Patterson directed the speedup, steel was on order for the three ammunition plants, but delivery schedules of course reflected original completion dates. Bids on steel for the armor-piercing core plant had not yet come in.[92] Early deliveries were now imperative, but prospects of obtaining them were bleak. The mills, already operating at capacity, were booked far ahead. Labor disturbances were threatening to choke off vital supplies of coal. Warehouse stocks were just about exhausted. "We are facing tough problems," Major Wilson stated. "When you take a plant scheduled for completion one year from now and try to complete it in five months, you have a job on your hands."[93]

The Operations Branch tackled the problem from several angles. Finding, on opening bids for the core plant, that steel would be "awfully late," Groves thought of switching to reinforced concrete but gave the idea up on learning that redesign would take too long. Pursuing what appeared to be another forlorn hope, Wilson scoured the country for reserve stocks of structural shapes.[94] By exerting pressure on mills and fabricators, Creedon obtained fairly good results. Suppliers agreed to step up deliveries to ammunition projects. "We have arranged to take certain materials from jobs scheduled for defense and otherwise," an official of the American Bridge Company explained, "and simply put back other jobs which may be as important as this." But the new schedules were not entirely satisfactory, for under them one building at St. Louis could not possibly be up by the end of September and three other structures at the same plant would be dangerously close to the deadline.[95]

On 28 April, in an effort to wring further concessions, Creedon conferred with representatives of American Bridge, Bethlehem, and the Mississippi Valley Structural Steel Company. Discussion revolved around the four buildings at St. Louis, which Creedon called "the key to the progress." The steel men held out little hope. Bethlehem's representative warned that further changes in rolling schedules would disrupt the whole defense program. "If you were given a priority, would that place the steel on these construction jobs ahead of anything

[91] (1) Memo, Wilson for Patterson, 19 Feb 41. 411.5 I. (2) Opns Br Files, Proj Behind Schedule. (3) Memo, Design Sec Arch Gp for Casey, 12 Apr 41. 411.5 I. (4) Memo, Design Sec for Leavey, 1 Apr 41. Opns Br Files, Ord Corresp. (5) Ltr, OZCQM 7 to Groves, 30 Apr 41. 600.914 (Iowa OP) I. (6) Compl Rpt, Indiana OW, 6 Nov 42, p. 384.

[92] Memo, Somervell for Campbell, 21 Apr 41. QM 635 (Ammo Plants) 1941.

[93] Notes of Conf, Creedon, Wilson, and Reps of Various Steel Companies, 28 Apr 41. Opns Br Files, Ord—Corresp.

[94] (1) Tel Convs, Groves and Mr. Giffels, Giffels and Vallet, 23, 24 Apr 41. Opns Br Files, Armor Piercing Core Plant, St. Louis. (2) Groves Comments, VIII, 9. (3) Memo, Wilson for Groves, 29 Apr 41. Opns Br Files, Ord—Corresp.

[95] Notes of Conf, 28 Apr 41, Creedon, Wilson, and Reps of Various Steel Companies. Opns Br Files, Ord—Corresp.

else you have?" Creedon asked him. "That would not help the situation at all," came the reply. "This schedule is as fast as it is possible to do it. It is a very remarkable schedule." The other industrialists set no great store by priorities, either. "I don't know what we can do that we have not already done," said one of them. Creedon encouraged the men to go back to their home offices and try once more to find a solution. There was no other course he could take.[96]

Professing a good deal of faith in preference ratings, Somervell meanwhile demanded that ammunition plants have top priority. On 24 April General Spalding had asked ANMB to assign these projects an A–1–b rating, but this request was no sooner granted than Somervell complained that the rating was too low.[97] He approached Spalding for an A–1–a priority. "The reaction was not favorable," Wilson told Groves. The only A–1–a ratings granted so far had been for machine tools to make other machine tools. Moreover, Patterson feared that too many top ratings would wreck the priority system.[98] Somervell persisted. On 29 April he telephoned from Denver. Telling Groves to send a transcript of the conversation to Patterson, he said: "Unless we can get the A–1–a priority on these three plants, I can't promise them to them by September 30. . . . If he wants to keep it A–1–b, it'll make it very doubtful as to the completion date."[99] This stratagem failed. On 30 April Patterson again refused to recommend an "A–1–a blanket priority," suggesting that Somervell might later seek the higher rating "on certain items" if necessary.[100]

The day he turned down Somervell's request, Patterson took a salutory step. Mincing no words, he urged OPM to place steel on the Critical List at once. "At the present time," he said, "we know that structural steel is going to various types of civilian construction, hotels, theaters, etc. Unless we can get more prompt deliveries than are at present indicated, our program on plants for which we have the greatest need will be months in arrears."[101] That afternoon he got word that steel would go on the Critical List the following day. He immediately passed the good news on to Somervell, advising him to take every advantage of the situation.[102] Somervell was gratified but did not relax his efforts to obtain top priority for the small arms ammunition projects.

He soon made another try. On 2 May he put it squarely to Patterson: procure an A–1–a blanket priority or forget about the 30 September deadline.[103] This time the Under Secretary gave way. Having just learned that the Navy had obtained A–1–a priority for several important projects, he contended: "A similar rating for Small Arms Ammunition Plants should be readily agreed to by the Navy since it is dependent on Army Ordnance for small arms ammuni-

[96] *Ibid.*

[97] Memo, Spalding for ANMB, 24 Apr 41, and 1st Ind, 25 Apr 41. Opns Br Files, Ord—Corresp.

[98] Memo, Wilson for Groves, 29 Apr 41. Opns Br Files, Ord—Corresp.

[99] Tel Conv, Somervell and Groves, 29 Apr 41. QM 635 (Ammo Plants) 1941.

[100] Memo, OUSW Prod Br for TQMG, 30 Apr 41. QM 635 (Ammo Plants) 1941.

[101] Memo, Patterson for Stettinius, 30 Apr 41. USW Files, Misc & Sub—Steel thru Dec.

[102] Memo, Patterson for Somervell, 30 Apr 41. 411.5 I.

[103] Memo, Somervell for Patterson, 2 May 41. QM 635 (Ammo Plants) 1941.

tion."[104] At a meeting of the OPM council on 6 May, Patterson spoke of the ammunition plants as the "most urgent Army requirement," and Knudsen agreed.[105] Two days later, ANMB rated St. Louis, Lake City, and Denver A–1–a.[106]

Gradually the outlook for the ammunition projects improved. Steel companies advanced delivery dates a bit further, and Major Wilson located warehousemen who claimed to have stocks of structural steel. If all orders were filled, all promises kept, Lake City appeared certain to meet the deadline; Denver, highly likely. All signs pointed to completion of the core plant during August and of three main buildings at St. Louis by the end of September. A fourth building at St. Louis was still in doubt but might possibly get in under the wire.[107] Groves, though encouraged, was skeptical. "It's a question of steel and various other things and that's why I'm not absolutely sure about it," he said of the prospect for completing the four plants on time.[108] Nor was he sure that warehousemen could deliver structural shapes. "Now we don't know," he mused, "lot's of steel people say they've got them, and other steel people say that they are lying and they haven't got them."[109] Others shared Groves' doubts. Colonel Dunstan, the Zone CQM at San Antonio, told that steel was promised to Denver on a given date, remarked: "Of course, that's not exactly the same as the steel rolling in there."[110] Even so, Somervell was confident. Late in May he assured Patterson that the plants would be complete on or before 30 September.[111]

All this was merely a preview of what followed. By May the shortage was growing worse and anxiety was spreading. From project after project came the report: construction delayed for lack of steel. Edgewood, Weldon Spring, New River, Hoosier, the Fostoria Chemical Warfare Plant, the Anniston Ordnance Depot—these and other projects called for help. The clothing renovation plants were in desperate shape. Scheduled for completion no later than 1 August, they were slated for deliveries of structural steel in September and October. Greatly concerned, Patterson persuaded OPM to issue blanket priority ratings to all projects experiencing difficulty with steel.[112] Buoyant, Somervell told his staff: "We can now obtain the priority ratings we desire on steel."[113]

Announcement of OPM's policy brought a flood of requests for priorities, and in due time many were granted. The new ratings, which ranged from A–1–h for bag loaders to A–1–b for explosives plants, seemed to inspire hope. Many now felt confident that steel would soon be forthcoming. But faith in priori-

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[104] 1st Ind, 5 May 41, OUSW to ANMB on the above.

[105] CPA, *Minutes of the Council of the Office of Production Management*, p. 18.

[106] Memo, OUSW Prod Br for TQMG, 8 May 41. QM 635 (Ammo Plants) 1941.

[107] (1) Memo, Wilson for Groves, 1 May 41. Opns Br Files, Ord—Corresp. (2) Memo, Creedon for Farrell, 5 May 41. Opns Br Files, St. Louis OP—Corresp.

[108] Tel Conv, Groves and Shaffer, 19 May 41. Opns Br Files, Ord.

[109] Tel Conv, Groves and CQM St. Louis OP, 30 Apr 41. Opns Br Files, St. Louis OP—Corresp.

[110] Tel Conv, Dunstan and Groves, 10 May 41. Opns Br Files, Ord.

[111] Memo, Somervell for Patterson, 27 May 41. 411.5 I.

[112] (1) Opns Br Files, Proj Behind Schedule. (2) Memo, Patterson for Somervell, 7 May 41. 411.5 I.

[113] Min, Constr Div Staff Mtg, 9 May 41. EHD Files.

ties, though prevalent, was to a large extent ill-founded. A haze of wishful thinking obscured the obvious fact that wholesale granting of priorities would weaken the system. "A preference rating is not a 'magic carpet'," Colonel Vandervoort reminded the CQM at Fostoria, adding:

> The mere assignment of one does not insure delivery of material by the date required. The principal step is to anticipate requirements and to place orders timely; then after placement a follow-up should be made with suppliers to determine whether difficulties have arisen which might delay deliveries.[114]

Vandervoort's advice was sound. A priority was little more than a hunting license.

Priorities became less meaningful as more projects acquired top ratings, a process compared by Donald Nelson to the depreciation of currency in a period of inflation. By mid-June Somervell felt impelled to ask for A–1–a ratings on all Ordnance plants. He did so with the backing of General Wesson, who requested the highest priority for processing equipment as well as for building materials. ANMB denied the request. Nevertheless, the number of plants with A–1–a ratings rose steadily. Just as steadily, the value of these ratings declined.[115] To illustrate, the Weldon Spring plant, after jumping from A–1–e in May to A–1–b in June, went to A–1–a early in July. But too late. Creedon reported that "many vendors held previous A–1–a priorities . . . which were given precedence, thus resulting in delay of material and equipment for this project." Elsewhere A–1–a ratings were likewise ineffective.[116] By August the priorities system had virtually broken down.

On 28 August President Roosevelt abolished the Priorities Committee of OPM and replaced it with the Supply Priorities and Allocations Board (SPAB) in the Office for Emergency Management (OEM). SPAB, as its name implied, not only exercised the priorities function but also allocated materials, that is, decided how much of the total supply of any critical commodity would go for defense, for foreign aid, and for civilian use. Early in September steel and pig iron went under complete mandatory priority control, which meant allocation of the entire national production of these materials. At the same time, SPAB ruled out priorities assistance for expanding plants with no defense orders. A month later it extended this ruling to all nonessential building. Henceforth priorities would go only to defense projects and to projects necessary for public health and safety. Although SPAB's criteria were vague, its orders had a marked effect. According to the New York *Times*, construction in the Eastern states declined 24 percent between October and December 1941.[117] But for first-wave munitions projects, the im-

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[114] Ltr, Vandervoort to CQM, Fostoria CWS Plant, 11 Jul 41. QM 161 (ZCQM 5) 1941.

[115] (1) Donald M. Nelson, *Arsenal of Democracy, The Story of American War Production* (New York: Harcourt, Brace and Company, 1946), pp. 141–45, 155ff. (2) Memo, Somervell for Patterson, 19 Jun 41, with Wesson's Ind. QM 635 (Ammo Plants) 1941. (3) Memo, ANMB for TQMG, 12 Jul 41. 161 (Ord Dept) (Pref Rat) Part 1.

[116] Incl with Memo, Creedon for Groves, 21 Aug 41. Opns Br Files, Weekly PR's—F. R. Creedon.

[117] (1) Executive Order 8875 (6 *F. R.* 6511), 28 Aug 41. (2) OQMG Circ Ltr 221, 2 Sep 41. (3) Reginald C. McGrane, The Facilities and Construction Program of the War Production Board and Predecessor Agencies, May 1940 to May 1945 (WPB Sp Study 19), pp. 67–70.

provement came too late. By the time SPAB's orders began to take hold, the program was nearly over.

Where production controls failed, the Construction Division fell back on other devices—expediting, conservation, and redesign. Within the organization were men who knew how to locate scarce items, trim requirements, and contrive acceptable substitutes. Heading up the expediting drive was Major Wilson, who displayed a marked talent for finding materials others could not find. Sparking the effort to conserve scarce commodities was Harry B. Zackrison, an able engineer who had been with the division since 1933. Directing the work of redesign was Colonel Casey, holder of a doctor's degree from the Technische Hochschule at Berlin and one of the most brilliant engineers in the Army. Seasoned construction officers in close touch with the field, men like Groves and Dunstan, furnished practical suggestions. So did many contractors. By working together, exchanging ideas, and considering problems from different angles, members of the construction team were able to cope with the shortage.

New standards and designs promised to save large quantities of steel. Concrete doors, timber trusses, lighter rail, reinforcing mesh instead of rods—these were some of the suggestions reaching Casey's desk. Others envisaged frame warehouses for inert storage and simpler rail and utilities systems. After reviewing these recommendations, Engineers, construction men, and Ordnance representatives endorsed most of them. Substitutions were many. For example, at the Ohio River ammonia plant, temporary wooden frames supported miles of heavy overhead piping; and at Kankakee, wood and concrete roof decks and timber framing were much in evidence.[118] Describing some of the measures taken to cut steel consumption, Colonel Leavey wrote in June 1941:

> Building designs, formerly accomplished in steel, have been and are being prepared, using wood and concrete construction. Much siding and roofing, which was formerly corrugated steel, will now be wood sheathing. Steel fence posts will now be of wood. These efforts have been made both to conserve steel and to decrease the time necessary to complete a project because of the delay in obtaining the necessary steel.[119]

Noteworthy among the new designs was one for igloos, the barrel-arched, earth-covered magazines of reinforced concrete used for storing ammunition. These structures were an outgrowth of the lightning-caused disaster which had flattened the Navy's ammunition depot at New Denmark, New Jersey, and part of neighboring Picatinny Arsenal in 1926. Designed in 1928, the standard igloo had two salient features—a semicylindrical shape which would direct the force of an explosion upward rather than outward and an elaborate system of lightning protection which included not only lightning rods but also steel reinforcing rods, closely set and welded. For some years before the emergency the Construction Division had argued unsuccessfully that the igloos were super safe. When Casey began his review of

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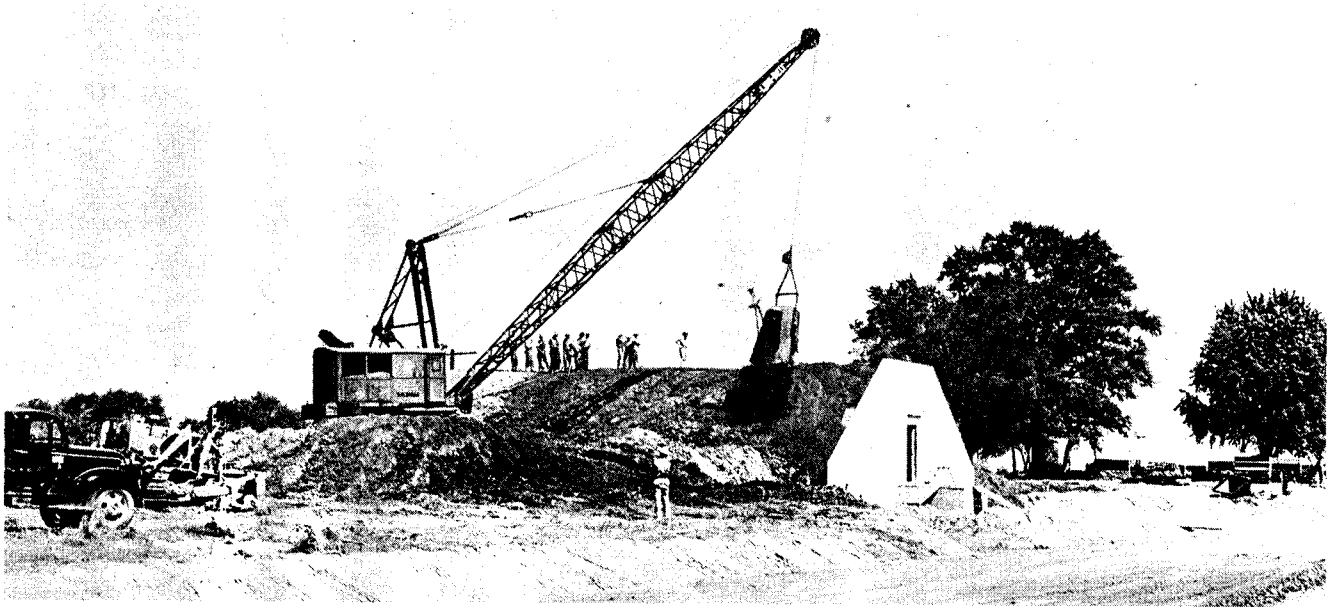
[118] (1) Notes of Conf between Reps of Ord Dept, OPM, and Constr Div, 17 Jun 41. 635 Part 1. (2) Memo, Casey for Leavey, 1 Apr 41. Opns Br Files, Ord—Corresp. (3) Memo, Arch Gp Design Sec for Casey, 12 Apr 41. 411.5 1. (4) Memo, Farrell for Groves, 6 Jun 41. Opns Br Files, Staff Mtgs—1941. (5) Compl Rpt, Ohio River OW, 31 Oct 42, p. 15. (6) Compl Rpt, Kankakee OW, 11 Aug 44, Sec 4.206.

[119] Memo, Leavey for Proc Control Br Plan and Control Div OQMG, 27 Jun 41. 400.8 Part 1.



CONSTRUCTING STANDARD IGLOO MAGAZINE

standard plans and drawings early in 1941, he gave the igloo design especially close scrutiny.[120] As Groves explained to one Ordnance officer, "If you're doing 20 or 30 [igloos] or even 100, it doesn't matter; but when you start to build about 1,000, why, then, if it's unnecessary, we certainly ought to know."[121] Casey consulted Dr. Karl B. McEachron, chief of General Electric's high voltage laboratory, about the system of lightning protection. He also weighed a proposal by Colonel Dunstan to eliminate tie beams by reinforcing the concrete slab floor to take the thrust of the arch. After careful study and many consultations, Casey adopted Dunstan's idea, reduced the number of reinforcing rods, eliminated a good deal of the welding, and modified footings and other details. In June, with McEachron's help, he persuaded Ordnance to accept the changes. The new design saved not only steel but labor and money as well. Casey took particular pride in the monetary saving—an estimated $800 to $2,000 per igloo. Since tens of thousands of igloos would eventually be built, the potential saving was indeed sizable.[122]

Systematic conservation reduced steel requirements still further. Beginning early in 1941, when he joined the Federal Specifications Committee on Metals, Zackrison continually searched the specifications with a view to conserving strategic and critical materials. In June, when Patterson inaugurated a comprehensive conservation program for the Army, Zackrison assumed additional duties as Casey's liaison with OPM. In time his contacts widened to include the new Conservation Section of the Com-

[120] (1) Thomson and Mayo, *Ordnance Department: Procurement and Supply*, pp. 360–61, 368. (2) 1st Ind, 12 Jun 41, on Ltr, OQMG to CofOrd, 21 May 41. 633 I. (3) Groves Comments, VIII, 14. (4) 633 I.

[121] Tel Conv, Groves and Maj Rogers, Ord, 6 May 41. Opns Br Files, Ord.

[122] (1) 633 I. (2) Opns Br Files, Igloos. (3) Notes of Conf between Reps of Ord Dept, OPM, and Constr Div, 17 Jun 41. 635 Part 1. (4) OQMG Constr Div Ltr 391, 6 Aug 41. EHD Files. (5) Ltr, Casey to EHD, 11 Jul 55.

modities Division, Planning Branch, OUSW, other government agencies, and various advisory committees of scientists and industrialists. Initially, Zackrison's object was to find substitutes for magnesium, aluminum, tungsten, nickel, and zinc. Savings of steel were incidental. For example, he switched from stainless steel to glass mirrors in order to save nickel. But before long he was giving special attention to steel. New details, such as brick and mortar manhole covers and wood shelving, appeared in the specifications. Many familiar features, such as top rails of chain link fences, disappeared. Most of the changes were relatively minor, important only for their cumulative effect. A few were major; for instance, substitution of flanged beams for I-beams reduced steel requirements on many structures 20 to 25 percent.[123]

In face of the growing steel shortage, Major Wilson applied more aggressive expediting tactics. He kept track of rolling schedules and inventory levels and stationed resident expediters at some of the larger mills. He asked zone and project CQM's to watch for signs of impending delays. At the first hint of difficulty, he dispatched a trouble-shooter to the project.[124] Occasionally, he used unorthodox methods. When contractors encountered difficulty in obtaining rail, he tried "to coax and bluff the railroad companies" into selling stocks of relay rail. When a scarcity of reinforcing billet steel threatened to shut down some jobs, he secured re-rolled rails from the railroads; Quartermaster projects received deliveries when "practically no one else in the country could buy rods."[125] Much of the steel for the armor-piercing core plant came from wreckers who had dismantled the Century of Progress buildings at the New York World's Fair.[126] So vigorous were Wilson's methods that protests were inevitable. A member of the ANMB Steel Committee complained about the routing of "requests for expediting deliveries of required materials to many different sources, with the consequent numerous telephone calls, conflicting instructions, wasted time and money."[127] Criticism notwithstanding, Wilson got results. By November 1941 he could report 18,000 successful expediting actions.[128]

The united efforts of Casey, Zackrison, Wilson, and others eased the pinch. Although many projects continued to have trouble with deliveries, few suffered seriously for want of steel.

Completing the First-Wave Plants

By mid-1941 the outlook was brightening. During July three new plants, Ogden, Elwood, and Iowa, began partial operation; the new Jefferson Proving Ground opened; the Detroit Tank Arsenal started quantity production; and

[123] (1) Memo, Zackrison for Casey, 10 Apr 41. Design Sec Info Office File I. (2) Directive, OUSW, 11 Jun 41, p. 1. (3) Memo, Design Sec for All Unit and Gp Chiefs, 14 Jun 41. Design Sec Info Office File I. (4) Memo, Leavey for Proc Control Br Plan and Control Div OQMG, 27 Jun 41. (5) OQMG Circ Ltr 221, 2 Sep 41. (6) 411.5 Part 1.

[124] (1) Memo, Wilson for Groves, 20 May 41. Opns Br Files, Orgn. (2) Ltr, Wilson to ZCQM 3, 18 Jul 41. Opns Br Files, ZCQM's. (3) Memo, Groves for Styer, 15 Nov 41. Opns Br Files, Augusta Arsenal. (4) Memo, Wilson for Groves, 10 Jul 41. Opns Br Files, Weldon Spring OW.

[125] Rpt, Activities of P&E Sec, 1941. EHD Files.

[126] Wilson's Comments on Constr MS, VI, 105.

[127] Memo, ANMB for Patterson, 14 Oct 41. USW Files, Misc & Sub—Steel thru Dec.

[128] Rpt, Activities of the Constr Div, Jul 40–Nov 41, pp. 64–65.

workmen finished the addition to Frankford Arsenal. On 15 July Patterson announced that the first-wave plants "commenced last fall . . . are either completed or approaching completion." He went on to state, "We believe that they will all be in operation in September." Moreover, he related, "Large quantities of components have already been manufactured and when production of other components at the new plants catches up we believe that the completion of critical items of equipment and ammunition will then quickly accelerate."[129] In a similar vein, Harrison reported "good progress on munitions plants," noting that "with minor exceptions the projects so far approved are well along." He predicted that September would "see in operation about one-half of the productive capacity of the plants" and that all the plants would be approaching full production by the end of the year.[130]

Confident predictions were more easily made than realized. Plants were susceptible to many of the same ills that had plagued camps and cantonments. Contractors sometimes muddled unfamiliar tasks. Constructing Quartermasters were not always equal to their jobs. Shortages of skilled workmen, scarcities of supplies, tardy reimbursements, and inadequate plans were recurring complaints. Groves and Creedon had proven techniques for coping with most of these difficulties. Disregarding line and staff channels, they maintained direct contact with the field. Weekly reports from every CQM, frequent inspections, and hundreds of telephone calls enabled them to keep their fingers on the pulse of the projects. They quickly diagnosed common ailments and applied standard remedies. Where deliveries were slow, they alerted Major Wilson. Where skilled workers were in short supply, they raised wage rates or authorized overtime. Where circumstances warranted, they put pressure on design consultants and field auditors. When Kankakee continued to slip further and further behind, they relieved the Ordnance officer who served as CQM and transferred Kadlec from Detroit to replace him. When friction developed between the CQM at St. Louis and officials of the Western Cartridge Company, they sent another officer to the job.[131]

Groves and Creedon's pharmacopoeia contained no preventive for work stoppages and slowdowns. Between the middle of March and the end of July, 29 strikes, most of them for higher wages, occurred at munitions projects; a total of 49,500 man-days was lost. Hardest hit were Ravenna with 31,100 man-days lost, Radford with 6,826, and Kankakee with 1,117.[132] How many slowdowns took place within this period and how deeply they cut into production was unknown. Kankakee and Elwood suffered to some extent.[133] By far the worst damage was at the St. Louis Ordnance Plant. In the spring of 1941, soon after this project got orders to speed up, signs of a slowdown were evident. "All crafts have a WPA gait," one of the contractor's representatives reported in mid-

[129] Truman Comm *Hearings*, Part 6, p. 1523.

[130] Memo, Harrison for J. D. Biggers, OPM, 23 Jul 41. QM 600.1 (Def Constr) 1941.

[131] (1) Opns Br Files, Proj Behind Schedule. (2) Min, Constr Div Staff Mtgs, 1941. EHD Files. (3) Rpt, Activities of the Constr Div, Jul 40–Nov 41, pp. 207, 219. (4) Opns Br Files, St. Louis OP.

[132] Statistical Tables, EHD, 1949, Strikes in the Mil Constr Program. EHD Files.

[133] (1) Ltr, E. J. Briggs, Briggs Constr Co., Chicago, Ill., to Truman Comm, 17 Jul 41. Opns Br Files, Ft Bragg. (2) 600.1 (Elwood OP) (Labor) I.

SOMERVELL ADDRESSING CONSTRUCTION FORCE AT ST. LOUIS ORDNANCE PLANT

May.[134] Bricklayers were especially dilatory, averaging 350 bricks a day on straight walls, where 800 to 900 was the norm. Terming their conduct "one of the outstanding disgraces of World War II," Groves related:

> Every effort was made within the power of our organization to make the bricklayers do an honest day's work. Despite repeated promises from Harry Bates, their international president, this could never be achieved. It reached the point where I personally informed Mr. Bates that, insofar as I was able, all brick work would be held to a minimum on Army construction, for the very definite reason that his members were unwilling to do an honest day's work. The number of bricks, per day per man, . . . remained pitifully small.[135]

On 5 July Somervell addressed a mass meeting of all artisans on the project and pleaded for more production, but to little avail. Opinion differed as to the reason for this and other slowdowns. One theory was that workmen were stretching out the work; another, that they were after more overtime; and still another, that the unions were attempting to create

[134] Min, Mtg, OCQM, St. Louis OP, 17 May 41. Opns Br Files, St. Louis OP—Corresp.

[135] Groves Comments, VII, 4.

more jobs. All these theories seemed plausible.[136]

Early in August, widespread trouble flared. An agreement effective on 1 August, between the AFL Building Trades Department and government defense construction agencies, eliminated double time premiums and established a universal time and a half rate for overtime, weekend, and holiday work.[137] On the 2d a rash of protest strikes broke out, all of them at munitions projects. During the next four weeks, 55,747 man-days were lost, more time than in the preceding five months, and this in spite of the fact that most of the strikers stayed off the job only over weekends. Thirteen projects were affected, including Kankakee, Morgantown, Plum Brook, St. Louis, Lake City, and Weldon Spring. The stoppages at Kankakee and Morgantown lasted only one day, but elsewhere they extended over several weekends. Of four major strikes which occurred at Army construction projects between July 1940 and September 1945, three took place during August 1941. A strike at the St. Louis Ordnance Plant involved all crafts and a total of 24,534 man-days lost. Beginning on 2 August this strike dragged on until 30 September. Lake City and Weldon Spring each lost 11,000 man-days in the course of three weekends.[138] Unrest hurt progress during the week even though everyone was on the job. As the CQM at Weldon Spring described it:

> The fact that at various times the different crafts would agree to work under provision provided by . . . [the Building Trades Agreement] and then later withdraw has seriously handicapped the work even though only one craft would refuse to go along. This [has been] unsatisfactorily reflected in all phases of operations and the confusion and dissatisfaction among the workers that were employed has necessarily resulted in a great loss of time during the week as well as on weekends.[139]

Thanks to the Building Trades Department, the commotion finally died down. When Coyne learned of the stoppages, he telegraphed national headquarters of the striking unions: "Contact your local union by wire requesting their immediate co-operation."[140] The Building Trades Department and the nationals faced a challenge—maintaining discipline among the rank and file. When the plumbers at St. Louis persisted in defying the agreement, the national president ordered immediate compliance and followed this up by telling his representative to assume jurisdiction and protect all those wishing to work. After this representative threatened to man the job with other plumbers, the local accepted the time and a half rate. As a "salve to the unions," Somervell authorized 10-hour shifts and hikes in basic wage rates at some projects.[141] By September the strikes had abated and the projects were regaining lost momentum.

Completion of plant buildings was timed to coincide with deliveries of

[136] (1) Rpt, OZCQM 7 to OQMG, 15 Jul 41. LRBr Files, St. Louis OP—Gen Corresp. (2) Comments of Gen Campbell on Constr MS, VIII, 83. (3) S Rpt 480, Part 6, Apr 6, 1942, p. 6.

[137] For a detailed discussion of this agreement see pp. 366–71, below.

[138] Statistical Tables, EHD, 1949, Strikes in the Mil Constr Program. EHD Files.

[139] Telg, CQM Weldon Spring OW to OQMG, 18 Aug 41. 600.1 (Weldon Spring OW) (Labor).

[140] Telg, Coyne to Attached List, 7 Aug 41. LRBr Files, Bldg and Constr Trades Dept.

[141] (1) Telg, President George Masterson, United Assn of Journeymen Plumbers, to F. T. Schlenzig, Gen Organizer, St. Louis, 3 Sep 41. (2) Telg, H. B. Deal & Co. to OQMG, 15 Sep 41. Both in LRBr Files, St. Louis OP. (3) Memo, Creedon for Groves, 11 Aug 41. Opns Br Files, St. Louis OP. (4) Ltr, Fruco Constr Co. to Somervell, 23 Sep 41. 161 (Fruco Constr Co.).

processing equipment. As the big structures were glazed and roofed in, as acid-resistant or spark-proof surfaces were applied to heavy concrete floors, as finishing touches were put to complex piping and electrical systems, crews began tooling up the plants. A function of the using services, procurement of the highly specialized processing machinery was immensely difficult. Secret patents were one obstacle. Specifications calling for scarce materials were another. Moreover few foundries and machine shops were equal to the job. Anticipating emergency needs, Ordnance in the late 1930's had obtained funds for securing machinery for small arms ammunition, powder, and loading plants. As Under Secretary Patterson pointed out, "The reserve machinery thus procured was of immeasurable value."[142] But the reserve was far from adequate. Despite prodigious efforts by Ordnance and Chemical Warfare officers and operating contractors to expedite production of additional equipment, deliveries were disappointingly slow. "In a number of cases," Groves reported, "extra expenditures were made to save time in construction which then stood idle while we waited for the last bit of machinery necessary to make it a productive unit."[143]

As the plants reached completion, unit by unit and line by line, there was an agonizing decision to make. To begin producing ammunition and explosives while construction forces worked nearby would be extremely hazardous. The dust and noise of construction would increase the risk of explosion. In event of an accidental blow, large numbers of workmen, unaccustomed to the perils of explosives, would be within the danger zone. Ordnance was justly proud of its safety record. So were munitions manufacturers, and especially DuPont. Safety was a "must" in their operations. Yet the nation's survival might be at stake. DuPont faced the issue one Sunday morning early in September 1941, when Groves held a meeting at Kankakee. The temporary DNT line at Kankakee, completed in May, had stood idle all these months. Now several TNT lines were almost finished.[144] At the conference Groves explained "that TNT was badly needed, that the shortage would be desperate in the event of war, and that undue regard for the lives and safety of a relatively small number of employees and the safety reputation of the DuPont Company and of the Ordnance Department were far outweighed by the possible thousands of casualties which would result from a shortage of TNT if war came." The project manager left the room and returned a short time later to announce that production would begin as soon as the first TNT lines were ready. "I assumed that he called Wilmington but did not ask him," Groves recounted. "I merely congratulated him on his announced viewpoint."[145] Other operating contractors adopted the same attitude. Plant after plant started up while construction was still in progress. Fortunately, there were no major disasters, though one minor explosion did occur in the latter part of 1941.[146]

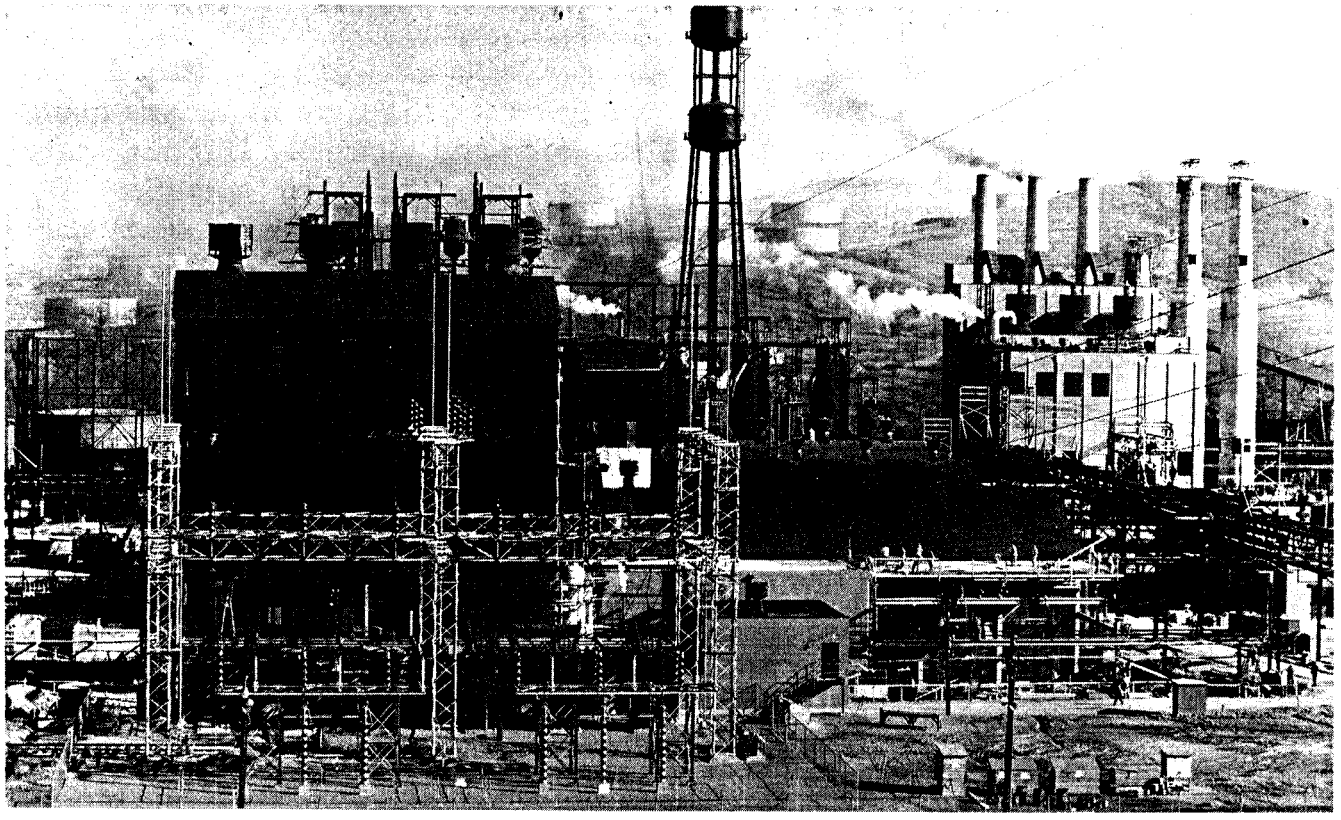
[142] Patterson's Testimony, 15 Jul 41. In Truman Comm *Hearings*, Part 6, p. 1521.

[143] Groves Comments, VIII, 6.

[144] (1) Ltr, CQM Kankakee OW to Somervell, 8 Sep 41. 600.914 (Kankakee OW) I. (2) Compl Rpt, Kankakee OW, 11 Aug 44, Introd, and Secs 1.407, 5.104, 5.201.

[145] Groves Comments, VIII, 7–8.

[146] Two melt loading buildings were destroyed in an explosion at the Iowa Ordnance Plant in December 1941. (1) Compl Rpt, Iowa OP, 15 Aug 42, Book I, p. 1. (2) Ltr, Groves to Dist Engr, Omaha, Neb., 3 Feb 42. 635 (Iowa OP) II.



MORGANTOWN ORDNANCE WORKS, WEST VIRGINIA

The number of Ordnance plants turning out munitions rose steadily. During August Kingsbury, Ravenna, and Wolf Creek began loading shells, the core plant at St. Louis went into operation, and the addition to Picatinny Arsenal reached completion. September saw production start at the Kankakee and Weldon Spring explosives works, the Hoosier and New River bag loading plants, and the Baytown toluol plant. On the 30th the Lake City small arms ammunition plant came through on schedule. Nine days later the Gadsden shell forging plant was ready to begin production. The Denver ammunition plant opened on 15 October, just seven months after the contractor broke ground. On the 20th the first lines at St. Louis were complete, though the plant produced no ammunition for another month. In November Morgantown began turning out ammonia. In December Plum Brook was in shape to produce TNT; and Coosa River, to load bags. By the end of 1941 only two first-wave plants, the Alabama smokeless powder factory and the Ohio River ammonia works, were not yet producing, and these two projects, both late starters, were ahead of schedule.[147]

Construction of Ordnance storage facilities kept pace with production. The five new ammunition depots—Anniston, Portage, Umatilla, Wingate, and Milan—were huge affairs, occupying a total of 110,812 acres. Together, they would provide 3,504 igloos with total floor space of 5,775,512 square feet and

[147] (1) Table, EHD, Compl Dates and Progress—Ord Plants. (2) List, Constr Div OQMG, 24 Nov 41, sub: Ord Plants, Scheduled and Actual Initial Opn Dates. EHD Files. (3) Rpt, OCE, Progress of Mil Constr 42, 31 Dec 41, pp. 117, 139.

38 large magazines with a total of 413,139 square feet.[148] Begun in the late winter and early spring of 1941, the depots made good progress. By late August, Anniston was 32 percent complete; Portage, 55; Umatilla, 30; Wingate, 65; and Milan, not started until June, was 5. At the end of the year, Milan was 84 percent complete; Wingate was 99; and the others were somewhere in between.[149] Provision of inert storage facilities was hardly less rapid. At Ogden 40 warehouses would store casings for the shell and bomb loading plant. By mid-October this $3-million job was 82 percent complete. "To date," Colonel Thomas reported, "thirty-one warehouses have been finished and made available for use, and virtually all of these actually are in use."[150] Elsewhere the story was much the same. None of the plants lacked adequate warehousing at any time.

The Chemical Warfare program came to a close in December 1941. Only one Chemical project had reached completion earlier—the Niagara Falls impregnite plant, which began production on 4 September. Handicapped by low priorities and shortages of expediting funds, the other eight jobs had fallen behind schedule. Deliveries of steel were months late. The contractors, unable to offer much overtime work, were at a disadvantage in the labor market. Through the autumn, as steel trickled in, the projects gained steadily but slowly. Then, spurred by the war crisis, they finished in a blaze of speed. The charcoal-whetlerite plant at Fostoria, Ohio; the impregnite plants at East St. Louis, Illinois, and Midland, Michigan; and the clothing renovation plants at Kansas City, Missouri, and Ogden, Utah—all were completed in December. The work of expanding and rehabilitating Edgewood Arsenal also wound up during the month. The two remaining projects, the clothing renovation plants at Columbus, Ohio, and New Cumberland, Pennsylvania, were ready for use at the turn of the year.[151]

Reporting to Gregory late in 1941, Somervell noted that "huge ordnance manufacturing facilities" stood where there had been "but vacant fields a little over one year ago."

> The whole interior of the United States of America [he wrote] has been transformed into a vast network of great munitions factories, the output of which will forever render this country free of dependence upon any other country for the tools of self-defense. . . .
>
> Today they are producing TNT and DNT, anhydrous ammonia, smokeless powder, toluol, shell forgings, small arms ammunition, armor-piercing cores for shells, armor plate, chemical warfare material, machine guns, rifles and tanks, while others are loading shells and powder-bags. Yet others have been recently authorized and still others are planned.[152]

Rounding out the first-wave plants and completing a second supplementary wave would take time and effort. But the big job was done. When war came to the United States, the new government-owned munitions industry was a reality.

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[148] Rpt, Activities of the Constr Div, Jul 40–Nov 41, pp. 30–32.

[149] (1) Constr PR 34, 30 Aug 41, pp. 78, 82, 88, 103, 98. (2) Rpt, OCE, Progress of Mil Constr 42, 31 Dec 41, pp. 119, 160, 117, 137, 165.

[150] Rpt, Activities of the Constr Div, Jul 40–Nov 41, p. 234.

[151] (1) Rpt, OCE, Progress of Mil Constr 42, 31 Dec 41, pp. 130–33, 134–35, 148–49, 174–75, 98–99, 100–101. (2) EHD, Constr of Chemical Warfare Facils (MS), 1944, p. 15ff. (3) Brophy, Miles, and Cochrane, *Chemical Warfare Service: From Laboratory to Field*, pp. 253–56.

[152] Rpt, Activities of the Constr Div, Jul 40–Nov 41, p. 119.